AUTOMOTIVE INDUSTRIES

AUTOMOTIVE and AVIATION MANUFACTURING
ENGINEERING • PRODUCTION • MANAGEMENT

NOVEMBER 15, 1958

In This Issue

A CHILTON PUBLICATION

it's mainly a matter of TIMING!

Knowing WHEN to replace obsolete equipment with a new Heald Bore-Matic saved over $54,000 a year!

A MACHINE doesn't have to be very old in years to be obsolete as far as production costs are concerned. And after all, the purpose of any machine is not just to produce, but to produce at a *profit*.

That's why replacement timing is so important. It depends not only on the age and productive capacity of the old machine—but on a careful cost comparison between the old and the *new*. Such a comparison, in terms of investment and return, will tell you when equipment should be replaced, and when it should be retained.

Our sales engineers are well experienced in making such obsolescence studies—on Borizing and grinding equipment. And they will be glad to do the same for you. Similar studies have pointed the way to many important savings.

For Example: A manufacturer of aircraft control equipment purchased a Heald Model 222 Bore-Matic to replace older equipment for boring, turning, facing and grooving on a wide range of parts. Later, their engineers made a detailed analysis on 12 different parts, to evaluate its cost-saving performance in specific terms. It was found that the machine would save over $54,000 in production costs—not only *paying for itself*, but netting a *profit* of over $29,000 in just the first year! The cost comparison, by groups of parts, is shown below.

	Old Method	New Machine
Annual Prod. Cost—Bodies	$53,004	$14,464
Annual Prod. Cost—Housings	18,124	4,917
Annual Prod. Cost—Carriers	3,276	1,404
Annual Prod. Cost—Plates	1,200	630
Total Cost per Year, all parts	$75,604	$21,415
Annual Saving for New Machine		$54,189
Total Purchase Price		$24,967
Net GAIN in One Year		$29,222

YOU pay for obsolescence. Replacement pays for itself!

THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

Worcester 6, Massachusetts

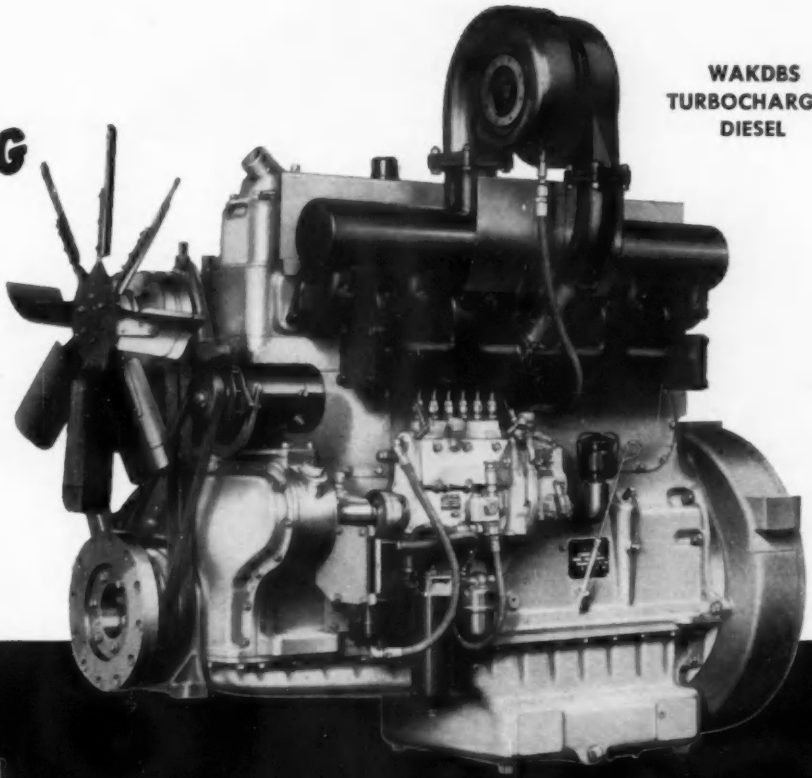
Chicago • Cleveland • Dayton • Detroit • Indianapolis • New York

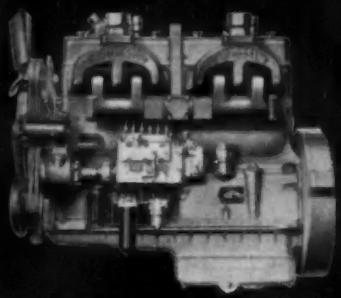
HEALD ®

Circle 101 on Inquiry Card for more data

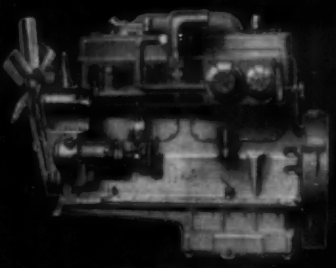
FOR HEAVY HAULING

WAKDBS TURBOCHARGED DIESEL





WAKDB NORMAL DIESEL



WAKR BUTANE

WAUKESHA

1197 CUBIC INCH
Extra Heavy Duty ENGINES

Up to 400 max. hp, *all with counterbalanced crankshafts*

Write for descriptive bulletins

Truck powered by Waukesha WAKR (Butane)

327-R

WAUKESHA MOTOR COMPANY
Waukesha, Wisconsin
New York Tulsa Los Angeles

B&W's Mr. Tubes

helps you engineer for profit

When a product involves the use of steel tubing, B&W's Mr. Tubes can help you *engineer for profit*—help you reduce costs and make a better product. Take for instance an application involving the use of alloy mechanical tubing.

From the standpoint of economics, there can be only one tubular product which is best suited for your particular fabrication procedures and optimum end use service. The choice of that tube involves the questions of the grade of steel itself, its heat treatment and mechanical properties, whether it should be electric furnace steel or the open hearth grade, whether it should be a hot finished or a cold finished tube. Other factors include surface finish, tolerances and the economical quantity and type of length.

These are but a few of the many considerations involved in buying the right tube for a job. Next time you are planning a product in which tubing is used—call in Mr. Tubes, your B&W district sales representative—and make him a member of your product planning team. He can help you as he has helped others. Write for Bulletin TB-361. The Babcock & Wilcox Company, Tubular Products Division, Beaver Falls, Pa.

B&W
TUBULAR PRODUCTS DIVISION

TA-8034-G7

Seamless and welded tubular products, solid extrusions, seamless welding fittings and forged steel flanges—in carbon, alloy and stainless steels and special metals.

AUTOMOTIVE INDUSTRIES

A CHILTON MAGAZINE — PUBLISHED SEMI-MONTHLY

NOVEMBER 15, 1958 — VOL. 119, NO. 10

FEATURES

NEWS PREVIEWS

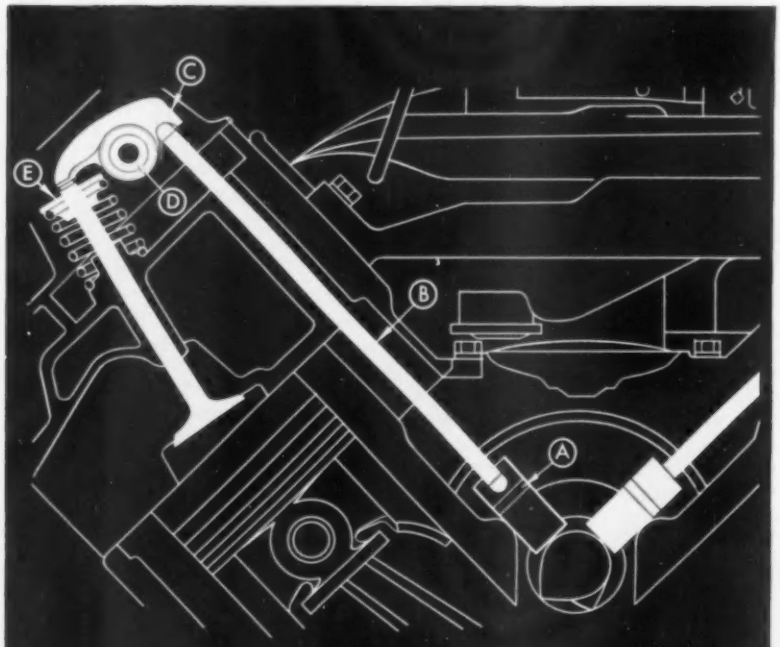
DEPARTMENTS

AUTOMOTIVE INDUSTRIES is a consolidation of The Automobile (weekly) and the Motor Review (weekly) May, 1902; Dealer and Repairman (monthly), October, 1903; the Automobile Magazine (monthly), July, 1907, and the Horseless Age (weekly), founded in 1895, May, 1918.

EDITORIAL EXECUTIVE OFFICES, Chestnut and 56th Sts., Philadelphia 39, Pa., U. S. A. Cable address—Autoland, Philadelphia.

AUTOMOTIVE INDUSTRIES. Published semi-monthly by Chilton Company, Chestnut & 56th Sts., Phila. 39. Second Class Postage Paid at Philadelphia, Pa.; Under the Act of Congress of March 3, 1879. Subscription price: To manufacturers in and suppliers to the automotive industries in the U. S., U. S. Possessions and Canada, $2.00 per year; $3.00 for 2 years. All Others, $10.00 per year. Single copies, 50¢. Statistical Issue, $1.00.

For all engines - - -



Chicago valve train parts in a typical V-8 automotive engine: (A) Hydraulic tappet, (B) push rod, (C) rocker arm, (D) rocker shaft, (E) valve spring retainer.

Passenger cars

Trucks

Tractors

Diesels

Aircraft

Everything you need in valve gear from CHICAGO

Here at Chicago you'll find a single source for everything you need in valve gear. These specialized facilities are solving problems and saving money for leading engine manufacturers . . . and can do the same for you.

Design and Engineering—at Chicago you'll find valve gear engineering experience in depth . . . men who understand your problems and will work with your engineering staff in designing cam shafts and complete valve gear assemblies for any type of engine.

Manufacturing—Chicago is a leading manufacturer of valve train parts. Our complete line includes precision-made hydraulic and mechanical tappets; push rods in both lightweight tubular and solid styles; valve adjusting screws including new self-locking screws that cut assembly costs; valve spring retainers; rocker arms and rocker shafts.

Testing—we have complete laboratory and engine testing facilities.

For the full story of how we can serve you, write our Tappet Division.

THE CHICAGO SCREW COMPANY

ESTABLISHED 1872 • DIVISION OF STANDARD SCREW COMPANY

2701 WASHINGTON BOULEVARD, BELLWOOD, ILLINOIS

resists impact

These horns are built to stand sudden shock. And Parish Pressed Steel Division of Dana Corporation, a leading manufacturer of automotive chassis and frames, uses A.W. Dynalloy steel for the same reason... resists impact!

There are other reasons, of course. A.W. Dynalloy is

... easy to form
... easy to weld
... resistant to corrosion

As with Parish Pressed Steel, A. W. Dynalloy can help you get more value per dollar spent for your product. Send for our A. W. Dynalloy booklet which gives complete information. Write Marketing Division, Dept. DY-E90.

A.W. DYNALLOY

ALAN WOOD STEEL COMPANY

steelmasters for more than a century and a quarter *CONSHOHOCKEN, PA.*

DISTRICT OFFICES AND REPRESENTATIVES: Philadelphia • New York • Los Angeles • Atlanta • Boston • Buffalo • Cincinnati • Cleveland • Detroit • Houston • Pittsburgh • Richmond • St. Paul • San Francisco • Seattle • Montreal & Toronto, Canada—A.C. Leslie & Co., Limited

POWER UP...

with **DENISON** hydraulic equipment... the **LEADERS** do!

Why? Because with field-proved *Denison 2000 psi hydraulic power* in their earthmoving equipment—leading manufacturers find they're automatically building in *lower operating costs* and month-after-month *continuous trouble-free performance* on the job.

Realistic field-tests prove the basic design advantages of 2000 psi Denison Vane Pump power: the *high volumetric efficiency is continuous* . . . never a drop-off in work speed or sluggish operation that slows equipment and adds cost to the job.

Three more features of Denison's 2000 psi vane pumps can save you money, too. Unique *balanced-vanes* automatically compensate for wear to keep pump efficiency high, maintenance cost almost nil. Exclusive "cartridge construction" makes in-the-field servicing extremely fast and simple. *All-weather starting* feature prevents pump damage—even under most severe conditions.

Add it up. Denison 2000 psi hydraulic power means continuous peak operating efficiency on the job. Costs are lower because *faster time cycles* are possible. Jobs *stay on schedule* . . . and *bids are more accurate* because you can *count* on a steady workload. Downtime . . . maintenance and repair costs are cut, too.

You guarantee less weight . . . less cost-per-horsepower *—more payload in your equipment* with a Denison 2000 psi Vane Pump as the heart of your hydraulic system.

Your Denison Hydraulic Specialist can tell you more about how to *significantly improve performance of your equipment* with hydraulic power up to 5000 psi . . . and how to make it *more profitable to the man who buys it.*

2000 PSI HYDRAULIC POWER

. . . is incorporated into dozens of types of earth-moving equipment by leading manufacturers. *Payoff:* Denison 2000 psi Vane Pumps help get jobs done faster . . . with trouble-free power to spare for toughest workloads.

DESIGNERS—ENGINEERS

Write for your copy of Bulletins 200 and 201—"How to Design More Efficient Hydraulic Power Into Mobile Machinery" and "Balanced Vane 2000 psi Hydraulic Pumps".

DENISON ENGINEERING DIVISION
American Brake Shoe Co.
1212 Dublin Road • Columbus 16, Ohio

DENISON HydrOILics

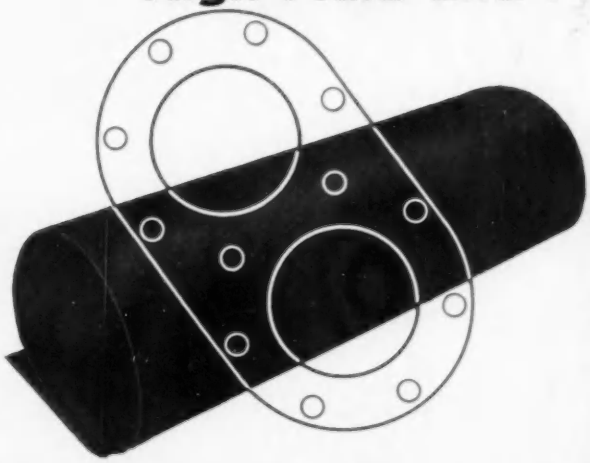
HYDRAULIC PRESSES • PUMPS • MOTORS • CONTROLS

Denison and Denison HydrOILics are registered trademarks of Denison Engineering Division, ABSCO.

Circle 108 on Inquiry Card for more data

VICTOPAC

Asbestos-Synthetic Rubber Gasketing Durable under Heat, High Fluid and Flange Pressures



Seals against oil, engine fuels (liquid or vapor) and coolants, steam, hot or cold water

Supplied in Sheets . . . or Finished Gaskets Made in standard thickness:
1/64" — 1/32" — 1/16" — 3/32" — 1/8"

This tough, completely homogeneous sheet packing is composed of long-fiber asbestos and synthetic rubber, bonded under heat and pressure.

While thoroughly dense in structure, Victopac has sufficient compressibility for effective sealing under light or heavy flange loading. Its resistance to heat permits usage where plant fiber packings deteriorate.

CONDENSED SPECIFICATIONS

Type	SAE-ASTM Spec.	% Compression 5000 Psi. Load	Recovery %	Minimum Original Tensile	Max. Thickness Change in ASTM Oil No. 1— 5 hrs. at 300 deg. F.
1	G-1111-1 *P1161A	12±5	40	1800 psi.	20%
1B	G-1111-1 (Federal Spec. HH-P-46A *P1161A	12±5	40	1800 psi.	20%
2 Graphite coated, one side	G-1111-1 *P1161A	12±5	40	1800 psi.	20%
3 Graphite coated, two sides	G-1111-1 *P1161A	12±5	40	1800 psi.	20%
50V	G-1122-1 (AMS 3232F) (Navy Spec. 33-P-13c) *P1141A	12±5	40	2000 psi.	10%
60V	G-1123-1 (AMS 3230 and 3231) *P1151A	12±5	40	2000 psi.	15%
70V	G-1122-1 (AMS 3232F) *P1141A	12±5	40	2000 psi.	10%

*Latest ASTM No. D1170-58T, SAE No. 90R and MIL-G-12803A specifications.

Made in 7 types — Typical uses

Victopac is widely specified for automotive and industrial machinery applications. Choice of seven basic types provides economical sealing for each use. All types conform to SAE-ASTM specifications and are certified to federal, military or customer specifications where needed.

Typical applications include speed reducers, transmissions, differentials, gear case covers, pipe flanges, refrigeration, pumps, oil coolers, internal combustion engines, etc. Victopac's uses are almost unlimited.

Test samples supplied free

Your inquiry, stating proposed application, will bring you sample sheets of recommended type with full technical data. Request through your Victor Sales Engineer or directly to factory.

Victopac is available in sheet sizes 58" x 62½" and 58" x 125". Write for special price list.

Victor Mfg. & Gasket Co., P.O. Box 1333, Chicago 90, Ill. Canadian Plant: St. Thomas, Ont.

VICTOR

Sealing Products *Exclusively*

GASKETS • PACKINGS • OIL SEALS • MECHANICAL SEALS

CP MAGNAMATIC MULTI-RUNNERS

make every operator a "quality control expert"

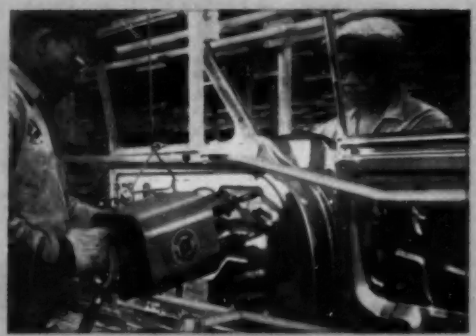
It's a proven fact that you can save considerable time and money on large volume work by running several fasteners at once with multiple spindle tools. But these savings go down the drain if your assembly operation includes expensive manual inspections to maintain product quality.

There's no need for "follow-up" hand tightening with CP Magnamatic Multi-runners. Inspection can be reduced to occasional spot checks. Quality control becomes part of the job – not a separate operation.

Magnamatic's patented clutch disengages when proper torque is reached. Nuts and bolts are consistently driven to the same torque – even by inexperienced operators. Clutch settings seldom require readjustment, despite variations in air pressure and motor wear.

Magnamatic Multi-runner units are available in five basic sizes, each adjustable within a wide range, to handle torques from ½ to 350 foot pounds.

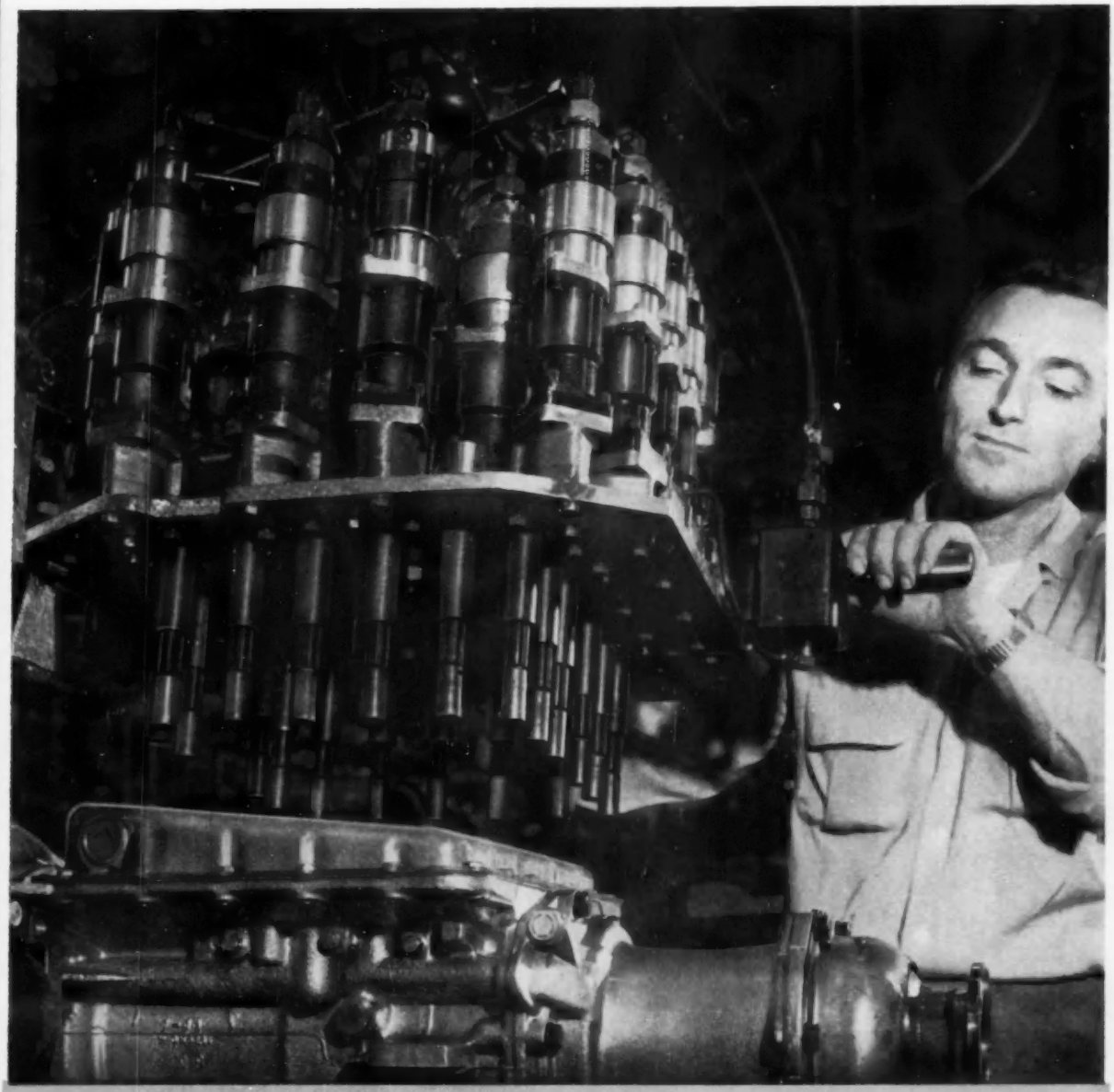
CP 15-spindle Multi-runner pulls up cover bolts evenly on torque converter pump



CP 4-spindle Magnamatic Multi-runner sets cap screws on window regulator with uniform tension, then releases instantly

Chicago Pneumatic

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES



Twenty-spindle CP Multi-runner cuts time on mounting transmission oil pan

Fast, accurate work on upper control arm bracket is made easy with CP 2-spindle Multi-runner

Chicago Pneumatic Tool Company, Dept. M93
8 East 44th Street, New York 17, N. Y.

☐ Please send me FREE Bulletin 580

☐ Have representative call

Name_____ Title_____

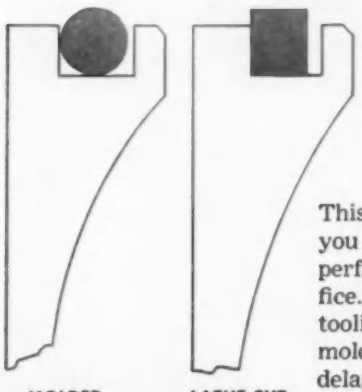
Company_____

Address_____

City_____ Zone____ State_____

Why ACADIA LATHE-CUT SYNTHETIC RUBBER SEALS

can save you money in *STATIC* or *MOVING* seal applications



MOLDED O-RING SEAL

LATHE-CUT SEAL

This seal will save you money with no performance sacrifice. Minimum tooling cost, no molds, no costly delays. Can be made up to 25" I.D.

Acadia Synthetic Rubber Parts are of the highest quality components, processed for oil resistance, good aging properties, resistance to heat. They can be furnished in any dimension or special compound you desire to precision tolerances. They are another example of Acadia's ability to SAVE YOU MORE..SERVE YOU BETTER.

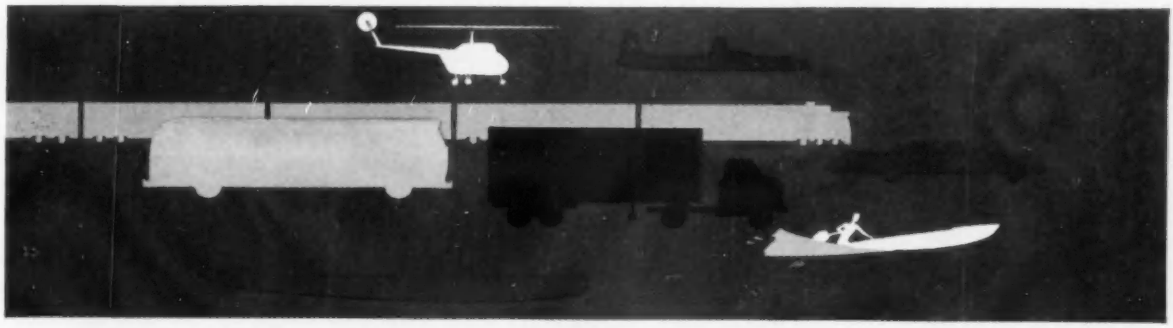
There's an Acadia Sales engineer near you to serve you. Write us today, and we'll put him in touch with you immediately.

ACADIA *Synthetic* **PRODUCTS**

DIVISION OF WESTERN FELT WORKS
Dept. A, 4021-4139 W. Ogden Ave., Chicago 23, Ill.
Branch Offices in Principal Cities

MANUFACTURERS AND CUTTERS OF WOOL FELT

WHEN IT COMES TO DRIVES



ON THESE TYPES OF INTERNAL COMBUSTION ENGINES

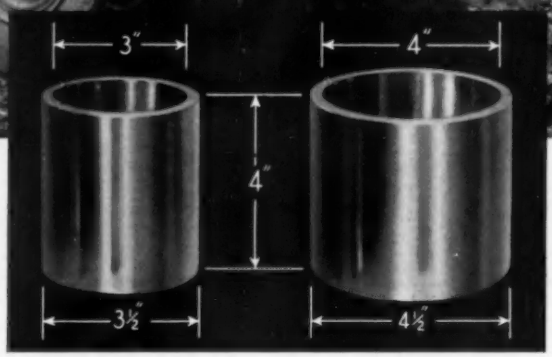
YOU START BETTER WITH BENDIX

For nearly fifty years Bendix* Starter Drives have been the recognized standard drive for all types of internal-combustion engines. Besides their more than 125,000,000 automotive installations, these units have also been given top preference in such diversified fields as aircraft, earth movers, outboard motors, submarines, and others. The reason *has* to be that Bendix drives deliver superior performance and are more reliable. In other words you can start *better* with Bendix.

*REG. U. S. PAT. OFF.

Bendix-Elmira
ECLIPSE MACHINE DIVISION
ELMIRA, NEW YORK

Bendix
AVIATION CORPORATION



OILITE

SELF-LUBRICATING BEARINGS

prove a match for top payloads on ATHEY Rear Dump Trailers

Oilite* Bronze Bearings have proven more than a match for the 22 and 34-ton payloads on Athey Rear Dump Trailers.

Oil-cushioned against shocks and impacts, these Oilite heavy-duty bearings have demonstrated that they will withstand years of punishment and still give satisfactory service. They require only infrequent lubrication and help Athey substantially increase the dependability of its hauling units. Yet, Oilite Bearings *cost less* than many other type bearings!

No wonder more and more designers are specifying popular Oilite self-lubricating Bearings for motor vehicles, appliances, engines, power tools, machinery and countless other products.

Contact your local Oilite Engineer today. He'll gladly provide complete design information to help you make your bearing and bushing applications low-cost, dependable and maintenance-free. Look for him in your telephone directory under "Bearings—OILITE" or write direct to Dept. K-11.

TYPICAL PROPERTIES OF SELF-LUBRICATING BRONZE OILITE BEARINGS †	
Porosity, %	18-23
Ultimate Tensile Strength, (psi)	18,000
Compressive Strength (psi)	20,000
Elongation, % min. in 1"	10
Brinell Hardness	40

† Other materials and physical properties available.

* REGISTERED TRADEMARK ONLY CHRYSLER MAKES OILITE

the most trusted name in powder metallurgy

SINCE 1929 — CHRYSLER PRODUCT — OILITE

AMPLEX DIVISION

CHRYSLER CORPORATION, DETROIT 31, MICHIGAN

SELF-LUBRICATING BEARINGS • PRECISION PARTS • METAL FILTERS • FRICTION UNITS

coming soon...

the coolest thing on wheels

the NEW STOPMASTER BRAKE!

Here are only some of the advantages the new Stopmaster brake will offer you!

COOLER OPERATING—For extended brake life and durability.

LIGHTER WEIGHT—For greater vehicle payload capacity.

LONGER DRUM LIFE—For more dependability—lower maintenance costs.

LESS BRAKE FADE—For safer . . . continuous operation.

LONGER LINER LIFE—For lower operating costs—less maintenance.

GREATER INTERCHANGEABILITY—Maximum number of common components for smaller parts inventory.

After years of research and development Rockwell-Standard will soon offer to the trucking industry the new Stopmaster brake, representing the most advanced brake design to be made available in three decades.

The Stopmaster has been proven by thousands of miles of rugged, demanding road trials . . . and by long hours of testing by trained technicians using the extensive laboratory facilities of the Rockwell-Standard Brake Division.

The many outstanding features of the Stopmaster brake make this design the answer to the industry's long-standing need for an improved, higher performance, more dependable brake.

Another Product of...

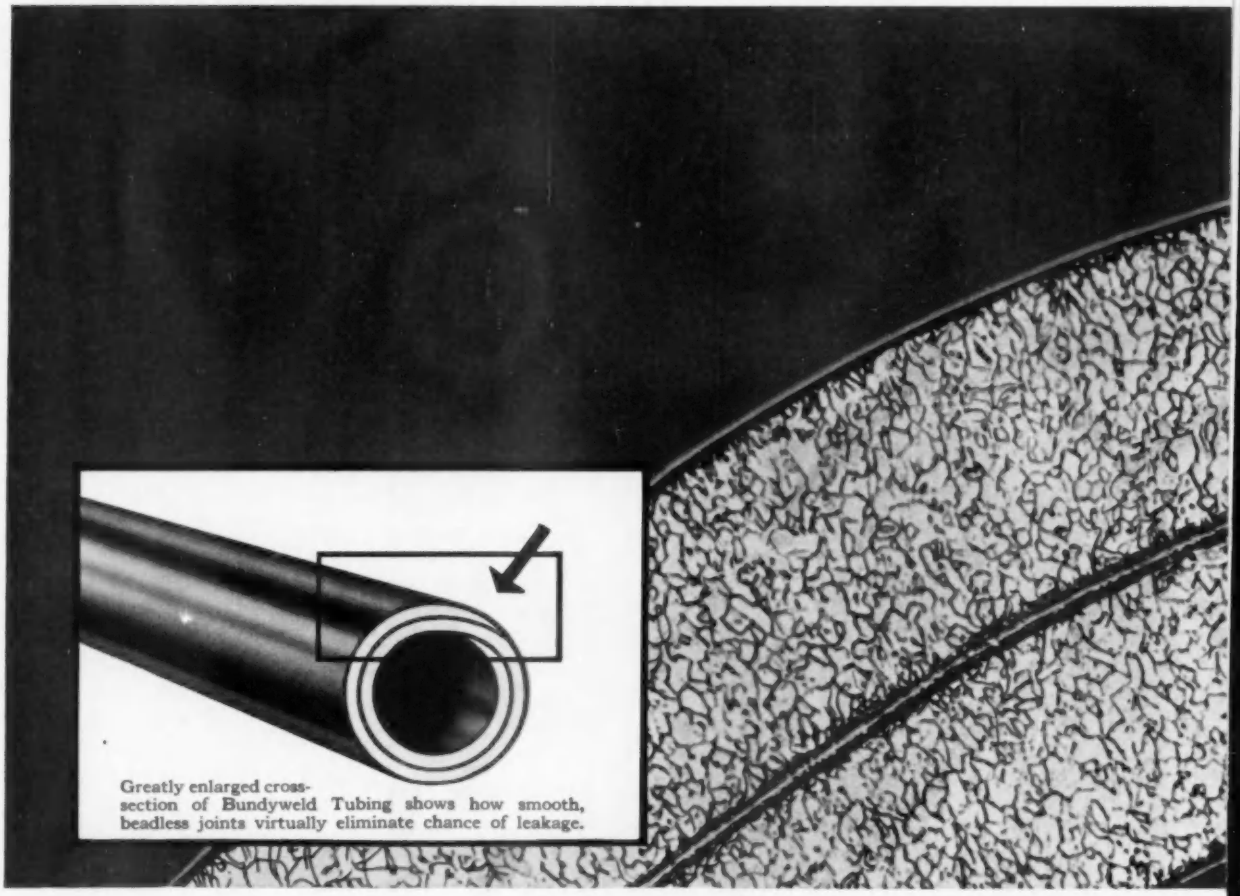
ROCKWELL-STANDARD CORPORATION

ROCKWELL R STANDARD

For every industrial, agricultural or automotive application where braking is required!

BRAKE DIVISION Ashtabula, Ohio

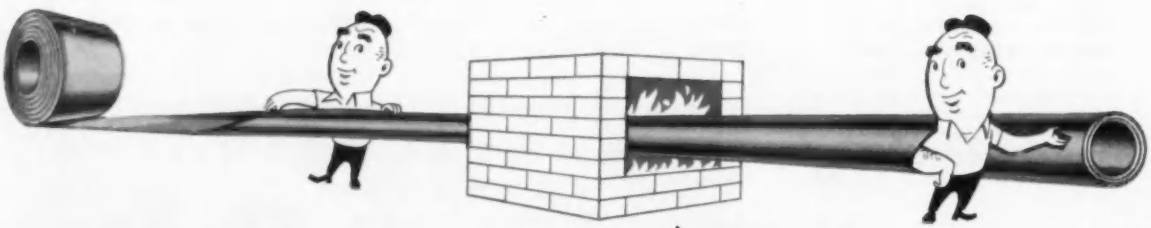
WHY BUNDY LEADS IN MASS-FABRICATION:



Greatly enlarged cross-section of Bundyweld Tubing shows how smooth, beadless joints virtually eliminate chance of leakage.

BEVELED EDGES...Another reason why Bundyweld

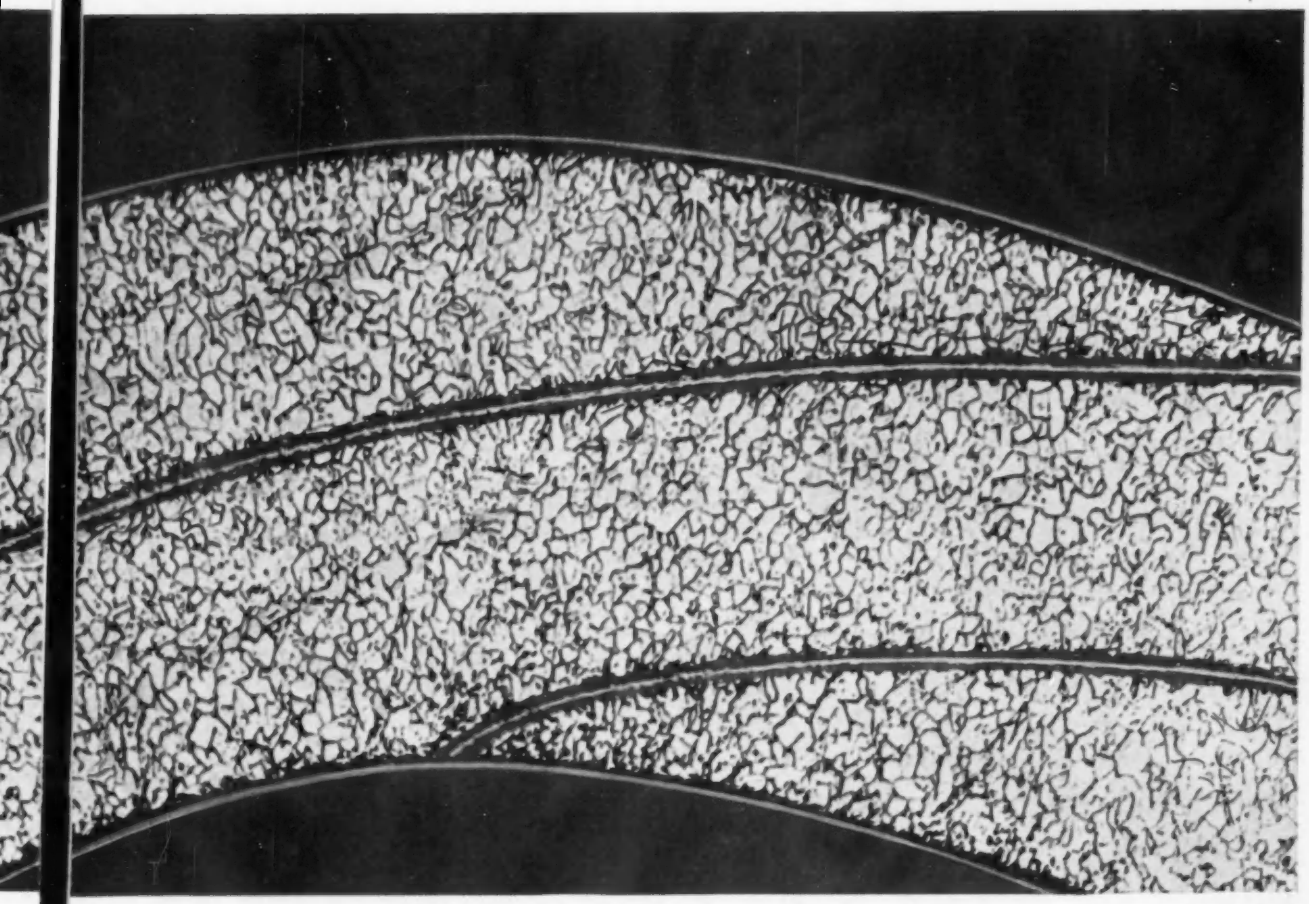
And Bundyweld can be mass-fabricated with speed and precision—at minimum unit-cost because of these Bundy advantages:



Bundyweld starts as a single strip of copper-coated steel. Then it's continuously rolled twice around laterally...

into a tube of uniform thickness, and passed through a furnace where copper coating fuses with steel.

Result: Bundyweld Tubing—double-walled, beadless, metallurgically bonded through 360° of wall contact.



is stronger, smoother, easier to fabricate

These Bundy®-developed beveled edges provide smooth, beadless joints, inside and out; insure full, double-walled strength however the tubing is cut or bent. They're *one* reason why Bundy leads in mass-fabrication; here are three more:

Bundyweld® Tubing is double-walled from a *single* strip, copper-brazed for high strength and resistance to vibration-fatigue in fluid-transmission *or* mechanical applications. From brakelines to pushrods, Bundyweld is on 95% of today's cars, in an average of 20 uses each.

Bundyweld designers are on call at any stage in the development of your product. They'll help work the kinks out of knotty tubing problems . . . find money-saving shortcuts with no compromise in function.

Bundy fabricators use special Bundy-designed fixtures and machines to mass-fabricate parts to your specifications, at low unit-cost.

Check *first* with Bundy! You'll get the best in small-diameter tubing, *plus* the finest design and fabrication services available. Call, write or wire us today!

BUNDY TUBING COMPANY • DETROIT 14, MICHIGAN

WORLD'S LARGEST PRODUCER OF SMALL-DIAMETER TUBING • AFFILIATED PLANTS IN AUSTRALIA, ENGLAND, FRANCE, GERMANY, AND ITALY

There's no real substitute for

BUNDYWELD® TUBING

Bundyweld and Bundy specialty tubings are sold through distributors in principal cities

120,000 of these detonator plugs

equal

one 73 lb. bumper strip

both are products of

ORCO CUSTOMEERING

The precision pigmy component weighs less than 3/10 of a gram and is an important part of a delicate detonator assembly. The 73-lb. bumper strip is a protective part of a "Dodgem" car in amusement parks.

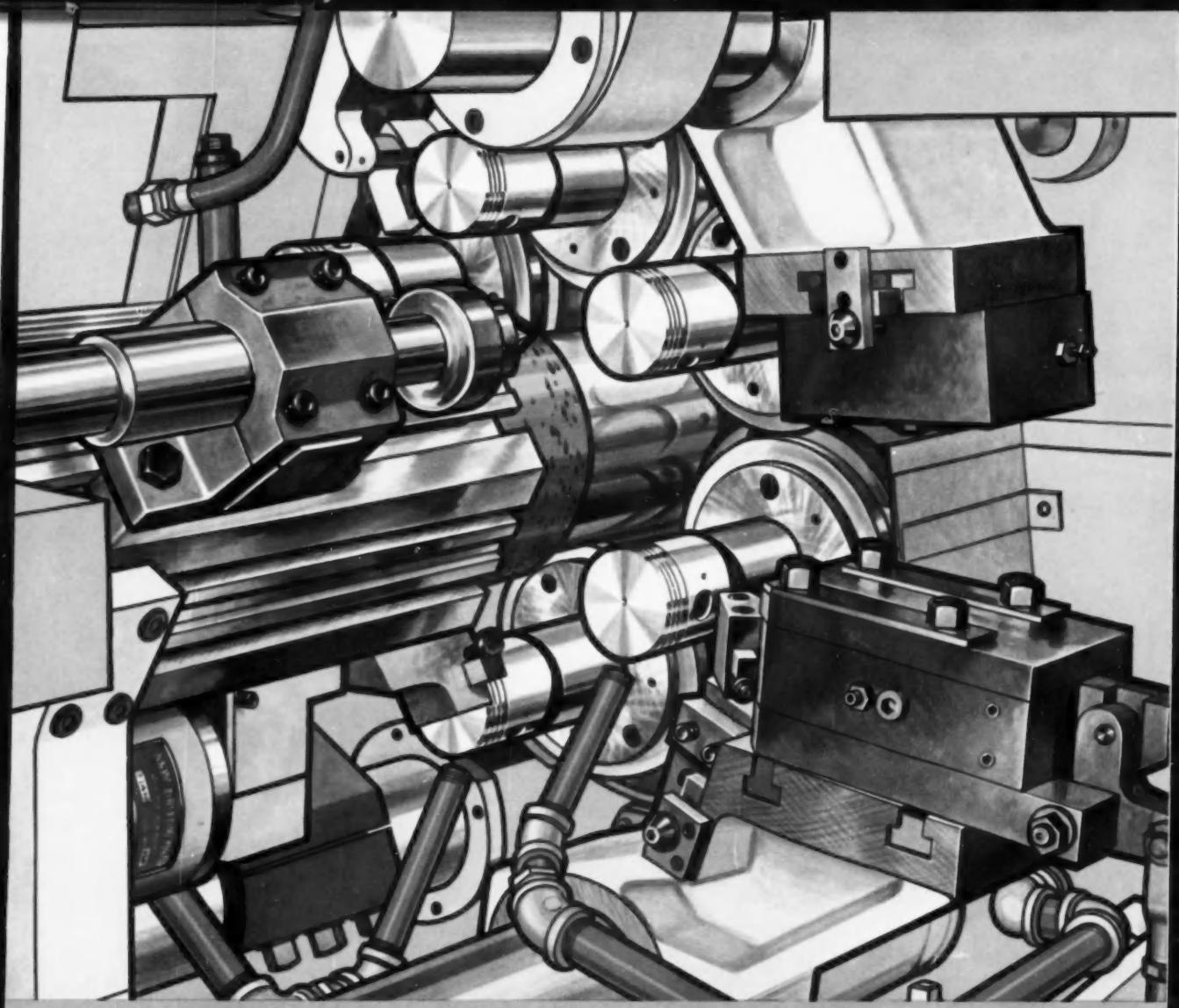
Big difference in size and application? Sure, but Ohio Rubber is recognized as a producer of "customeered" parts made from rubber, synthetic rubber, silicone rubber, polyurethane, and flexible vinyl, in *all sizes,* for any application, and whether molded, extruded, or bonded to metal.

From design through electronically controlled compound mixing and production facilities in four plants, Ohio Rubber's integrated set-up is prepared to handle your most exacting rubber and vinyl component requirements. Let ORCO engineers help on your next problem. See how ORCO CUSTOMEERING can work to your greater advantage.

Send for free booklet "Component CUSTOMEERING rubber and vinyl parts."

THE OHIO RUBBER COMPANY

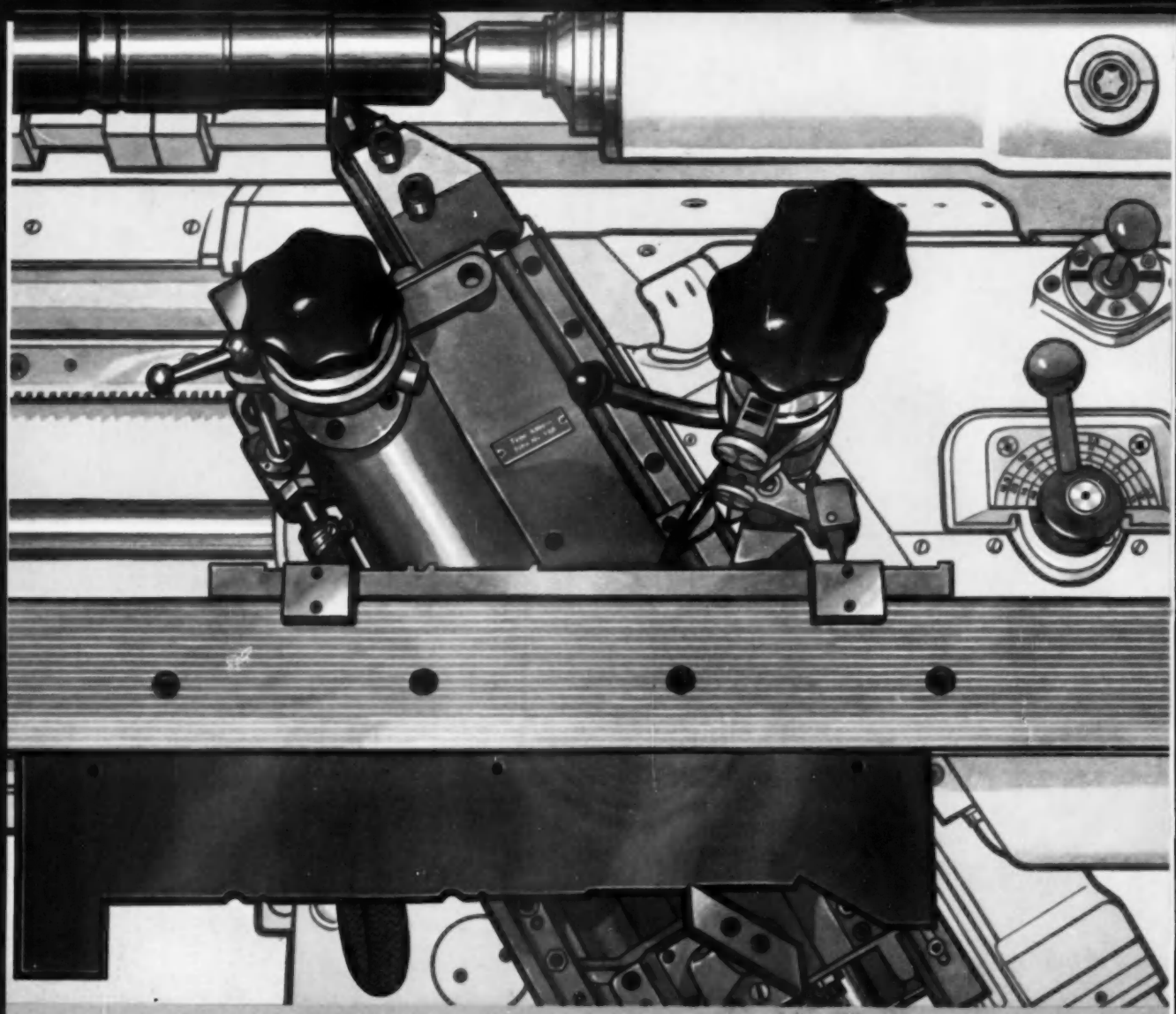
A Division of The Eagle-Picher Company
Willoughby, Ohio



make higher production pay for itself

A New Britain four-, six- or eight-spindle chucker with open-end design, massive forming arms, large capacity (up to 15″) will machine your castings and forgings faster at less cost. You can measure it in *income* instead of *cost* because New Britain Chuckers pay as they go. New Britain's new financing plan makes large initial investment unnecessary. New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Connecticut.

NEW BRITAIN CHUCKING MACHINE



you don't make money adjusting tools

With a New Britain +GF+ Copying Lathe you outproduce gang tool setups because you cut at maximum speeds and feeds for tool efficiency. No tool-wear worries! The single tool is changed in one minute. Every dimension is positively transmitted from template to work, making adjustment a simple matter of bringing one dimension to size — the others *have* to be right. New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Connecticut.

NEW BRITAIN +GF+ COPYING LATHE

Technical-ities

By John S. Davey

The strength of nuts

With a hard, heat treated nut, ability to plastically adjust and distribute load over many threads diminishes. High loads tend to concentrate on first thread severely enough to cause stripping . . . or fracture of first thread, which causes locking. Nut then cannot increase tension in bolt.

Untreated nuts are strong enough for most needs, and don't pose this problem.

A CAUSE OF STRIPPING

Upon tightening, a nut both compresses and dilates. Dilation can be overcome by wall thickness only, not by added height or heat treatment.

Dilation is important since a reduction in area of bolt under tension accompanies it. Threads pull away from each other, from their stronger base to weaker tips. The shallowness of *fine* threads can cause progressive shear.

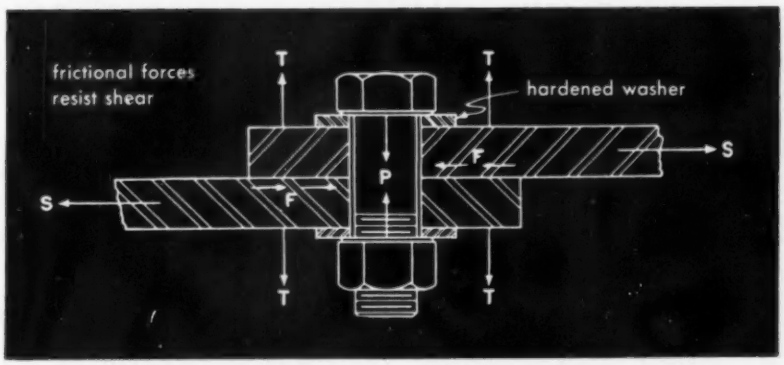
That's why High Nuts (with fine threads) are no answer where "Heavy" Nuts (with coarse threads) are.

WRENCHING STRESS HIGHEST

Rotation of nut produces both tension and torsion in bolt. The force applying this combined stress is about 20% greater than the load which must be sustained when rotation stops.

Thus . . . if a nut hasn't failed in wrenching, it can still withstand at least 20% more direct pull than it sustained during the tightening.

Why high strength bolts make superior joint for dynamic loads



Washers prevent crushing under head and nut with consequent grip relaxation.

While fasteners must be strong enough to carry the calculated loads, what makes a *joint* truly strong is the *residual tension* after wrenching.

NO SLIP OR SEPARATION

Consider the simple lap joint in sketch. Practically rigid, this joint is subjected only to: (1) external tension forces "T" tending to separate the plates against bolt clamping force "P"; (2) shear forces "S" tending to make plates slip against friction resistance "F".

"F" increases when "P" does. With enough clamping force applied, shear loads transfer from one plate to the other without slippage. And when clamping force always exceeds tensile forces, plates obviously *cannot* separate. There can be no further stretch on bolt. Its load stays static at preload "P", even when external loads are dynamic.

UNIFORM CONTROL OF PERFORMANCE

RB&W high strength bolts allow a high magnitude of clamping force to be applied . . . and *uniformly* so. Materials conform to ASTM specifications. Applying known torques to nut produces uniform bolt tensions. Riveting by contrast, depends on difficult-to-control variables.

MORE STRENGTH OVERALL

For shear-resistance, riveted joints offer only the actual rivet shear strength. Don't count too much on friction even though rivets exert some grip as they cool. Compare: a 1-inch bolt tightens to a tension of 42,000 lbs; a 1-inch rivet develops 22,000 lbs at best.

The higher residual tension does more than make a joint much stronger in shear and in tension. It also protects the bolt against fatigue caused by stress-reversing cycles such as vibration; keeps the bolt from loosening, too.

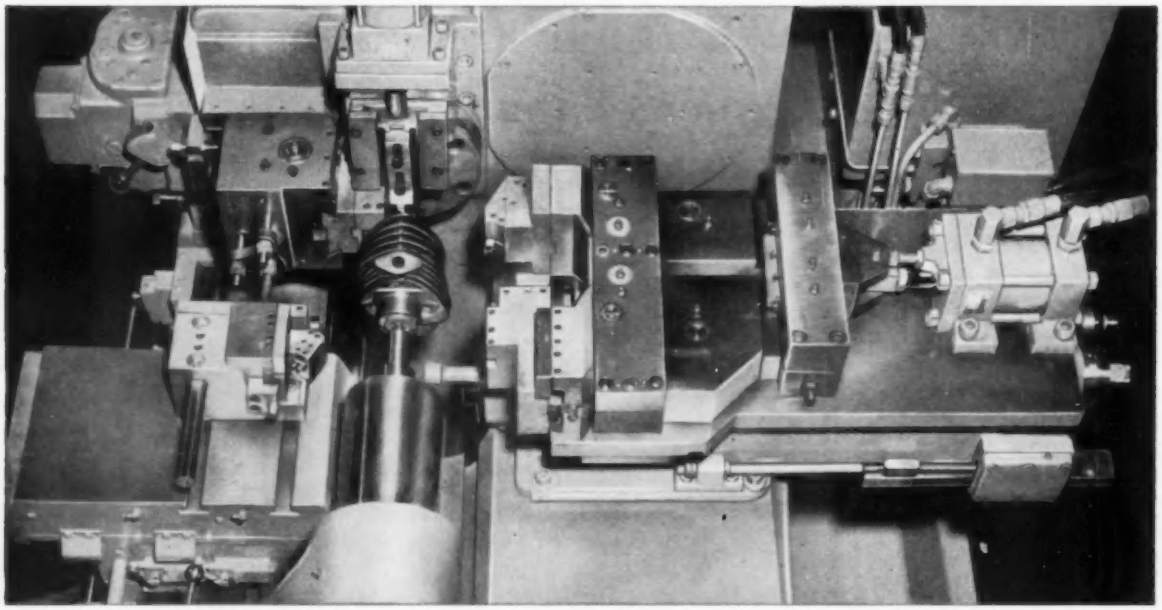
All this explains why, under heavy dynamic loads, rivets can loosen, elongate holes, often fail, requiring difficult replacement; but high strength bolts stand up. They can keep connections permanently tight on vibrating machinery, heavy duty conveyors, and transportation equipment.

Talk it over with an RB&W fastener expert. Russell, Burdsall & Ward Bolt and Nut Company, Port Chester, N. Y.

RB&W high strength bolts are from selected grade of medium carbon steel with proper combination of ductility and tensile strength; conform to ASTM A325.

Plants at: Port Chester, N.Y.; Coraopolis, Pa.; Rock Falls, Ill.; Los Angeles, Calif. Additional sales offices at: Ardmore (Phila.), Pa.; Pittsburgh; Detroit; Chicago; Dallas; San Francisco.

Six different sizes and types of workpieces are handled easily on this job. Extra expanding mandrel and sleeves at right are for different sizes.



How Harley-Davidson speeds motorcycle part production

Machines both ends in single chucking, using Gisholt No. 12 Automatic to get maximum accuracy, cut production costs

This well-planned setup reveals how Harley-Davidson Motor Co., Milwaukee, Wis., is handling cast iron front and rear cylinders.

Smart tooling on a Gisholt MASTERLINE No. 12 Automatic Production Lathe handles 6 different sizes and types of workpieces. Change-over is fast and easy. A special headstock-mounted, air-operated locating stop speeds work handling.

While tools in the front carriage turn and chamfer at one end of the piece, tools in a headstock-mounted auxiliary slide chamfer the I.D. on the other side. Simultaneously, tools on the rear slide face both ends for length. At the end of the cut, tool blocks on the rear independent slide swing open automatically to provide tool relief before withdrawal. Floor-to-floor time on the part shown is 1.2 minutes, only 1.8 to 3.6 minutes for the other 5 workpiece types and sizes.

The new Gisholt MASTERLINE No. 12 Automatic Production Lathe is designed specifically for high production operations; yet, it is flexible enough to handle a variety of similar parts in small repeat lots. The automatic cycle frees the operator to handle other machines or do other work.

Make a note to phone your Gisholt Representative today. Ask him to come in and show you where the fast automatic cycle and flexibility of the No. 12 Automatic Production Lathe can cut your floor-to-floor time and reduce your costs.

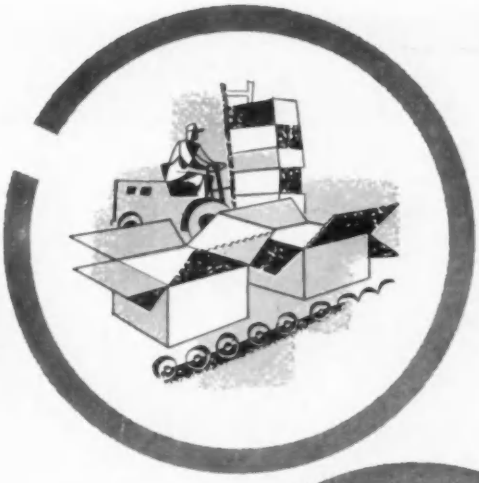
MASTERLINE GISHOLT SINCE 1887 GISHOLT

GISHOLT MACHINE COMPANY

Madison 10, Wisconsin, U.S.A.

WRITE GISHOLT TODAY for advance data on the new Gisholt MASTERLINE No. 12 Automatic Production Lathe. Ask for Form 1178.

Circle 118 on Inquiry Card for more data



RING SERVICE

that stays ahead of your production deadlines

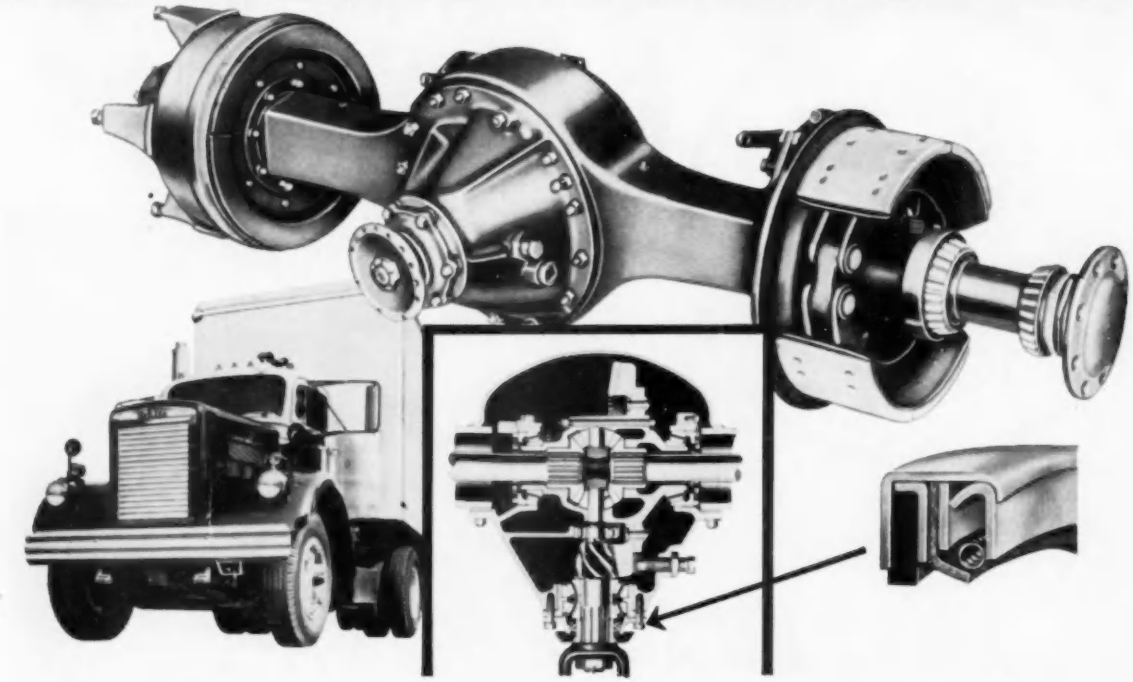
Nothing succeeds like *timing* . . . especially in a mass production world where output can be measured by the minute! That's why McQuay-Norris service includes unusual precautions to assure delivery *when* and *as* specified!

Call us. We're ready to serve you.

McQUAY-NORRIS
MANUFACTURING CO. St. Louis • Toronto

Largest Producer of Small Rings in the Automotive Industry

NATIONAL OIL SEAL LOGBOOK



How White Trucks employ dual-lip National seal to protect axle pinion assembly

The use by the White Motor Company of a National 15,000 series oil seal in their 189C Single Reduction Rear Axle is a skillful employment of a standard-design seal to attain dependable and economical sealing.

Conditions at the sealing point are: S.A.E. 90 gear oil to be retained, dirt and water to be excluded, temperatures —20° to 180° F with normal operation at 150° F, maximum shaft speed 3,500 rpm, eccentricity and runout .002, shaft diameter 2¾", 15 RMS finish. Operation is of course intermittent with servicing conditions generally good.

Rather than two seals to respectively retain lubricant and exclude foreign matter, White engineers specified National 15004, a dual-lip Micro-Torc leather and felt seal wherein the leather sealing lip is spring-tensioned and faces inward to retain gear oil and the other felt lip is a wiper excluding dirt and dust.

National 15004 is but one of 2,500 different standard design seals National provides. For complete information on leather, synthetic rubber or other seals, call your National Applications Engineer. Look under Oil Seals, in the Yellow Pages.

Before specifying seals, consider all these points!

Shaft RPM, Runout, Endplay
Is seal rated at or above anticipated operating extremes?

Temperature, Lubricant Types
Will heat or special-purpose lubricants attack sealing lip material?

Presence of Dirt, Foreign Matter
Point often overlooked. Should dual-lip or double seal be used?

Cost Related to Seal Design
Will a simpler, cheaper seal do as good a job as a more sophisticated design?

New Seals and Material Available
Are there new materials or compounds which can do the job better?

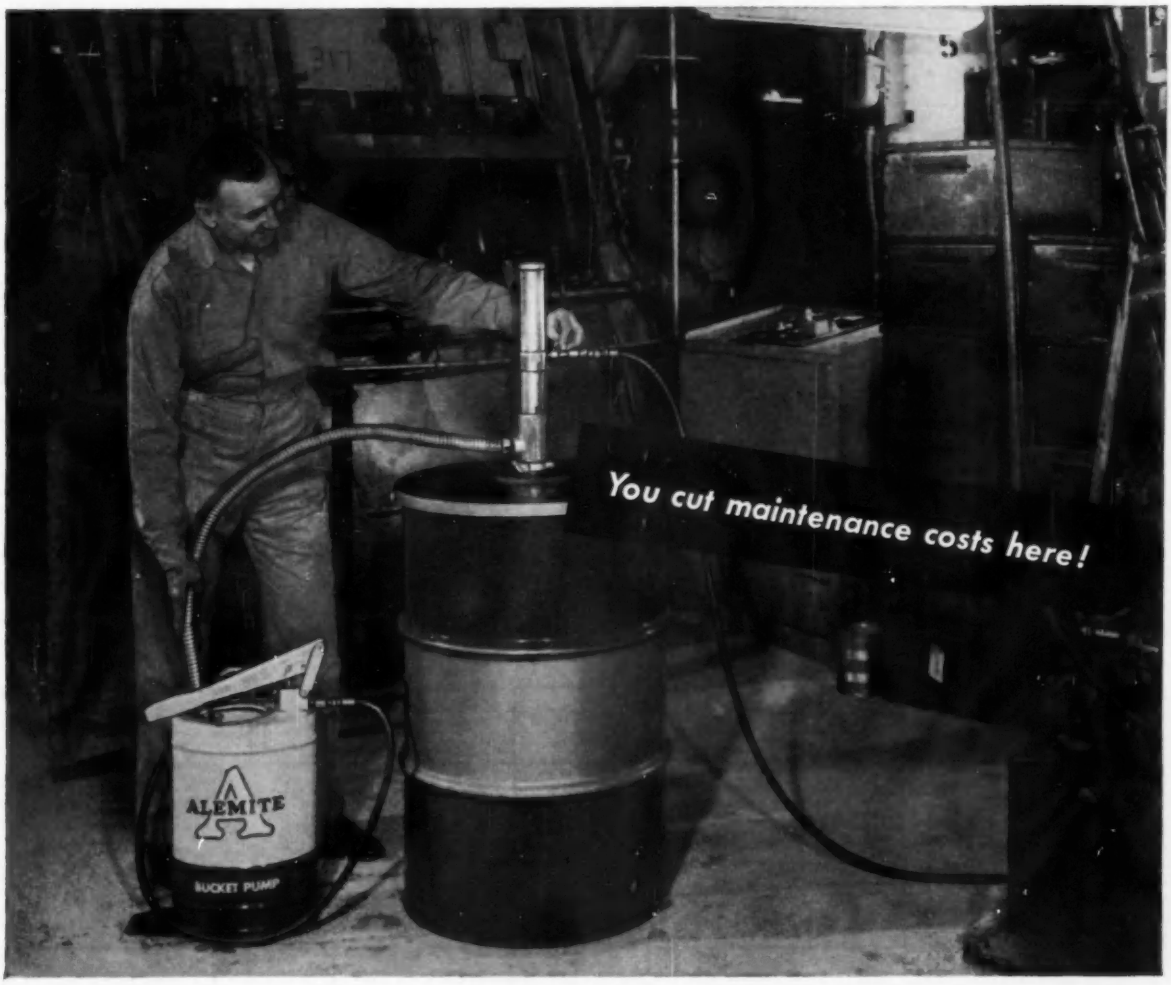
Special Design Oil Seals
Not all problems can be met with stock seals. Is special factory design indicated to meet special problems?

Delivery, Reputation
Is my proposed resource noted for good delivery, uniform quality and good follow-up service?

Don't specify "blind." Your National Seal Applications Engineer has up-to-the-minute oil seal information. Ask him—before you specify. Takes only a phone call; no obligation!

NATIONAL SEAL

Division, Federal-Mogul-Bower Bearings, Inc.
General Offices: Redwood City, California;
Plants: Van Wert, Ohio, Downey and Redwood City, California



Alemite Power Transfer of Lubricants Is 63% Faster Than Hand Method!

Wherever old-fashioned hand methods are used to transfer lubricants from original drums to other containers, time and money are wasted!

This high-speed, air-powered Alemite Transfer Pump transfers 37 pounds of pressure gun grease per minute, direct from original drum to loader pump, bucket pump or power gun. This gives you 63% faster transfer than by hand! And lubricant is always sealed—fully protected against mess, waste and contamination.

Pump also handles alcohol, cutting oils, kerosene—almost any non-corrosive, non-abrasive fluid used by the drum. Synthetic rubber air piston requires no oiling. Fully adjustable delivery rate . . . weighs only 15½ pounds!

Step up to fast-moving, time-saving transfer of fluid and semi-solid materials. Check Alemite's complete line of lubrication equipment for industry.

Symbol of SW Excellence

ALEMITE
DIVISION
STEWART-WARNER
CORPORATION

1850 Diversey Parkway, Chicago 14, Illinois

—MAIL COUPON FOR COMPLETE INFORMATION!—

Alemite, Dept. U-118
1850 Diversey Parkway, Chicago 14, Illinois

Please send me your complete catalog of Alemite industrial lubrication equipment.

Name .....

Company .....

Address .....

City ..... Zone ..... State .....

Castings of

ARMASTEEL®

so tough they replace forgings so machinable...they reduce finishing costs

CLASSIFICATION	CHARACTERISTICS	HARDNESS (BHN)	MIN. TENSILE STRENGTH (PSI)	MIN. YIELD STRENGTH (PSI)	MIN. % ELONGATION IN 2 INCHES
ARMASTEEL GM 86M	Recommended for less highly stressed parts. Replaces steel parts in 1020-1035 S.A.E. range.	163-207	70,000	48,000	4.0
ARMASTEEL GM 85M	Recommended for moderate strength plus adaptability to selective hardening. Replaces parts in 1035-1050 S.A.E. range.	197-241	80,000	60,000	3.0
ARMASTEEL GM 84M	Recommended for high degree of strength. Replaces heat-treated parts in 1040-1050 S.A.E. range.	241-269	100,000	80,000	2.0
ARMASTEEL GM 88M	High resistance to wear and high yield strength, yet retains machinability. Requires no heat-treating and possesses same strength and wear characteristics as alloy steel forgings.	269-302	105,000	85,000	2.0

CENTRAL FOUNDRY DIVISION

Because ARMASTEEL castings are so machinable, so resistant to wear and shock, and so adaptable to selective hardening, they are rapidly replacing many parts formerly machined from bar stock or steel forgings.

ARMASTEEL, a pearlitic malleable iron, possesses the same strength and performance characteristics usually associated with plain carbon steel. In addition, ARMASTEEL contains excellent bearing properties, has high yield strength, good damping capacity, maximum rigidity and excellent fatigue life. Accurate control of heat-treating operations in the manufacture of ARMASTEEL produces a fine, uniform grain structure and provides excellent finishing qualities.

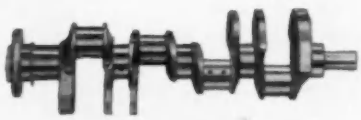
Four different types of ARMASTEEL can be cast to your specifications. One of the four (GM 84M, GM 85M, GM 86M or GM 88M) will have the physical properties to best meet the requirements of your application. For example, ARMASTEEL castings are being successfully used in the automotive, appliance and implement fields for such parts as gears, pistons, crankshafts, rocker arms and universal joint yokes, all of which utilize to best advantage the outstanding characteristics of ARMASTEEL.

Some of these applications are shown in the table. Look them over carefully; you may find that these characteristics and advantages of ARMASTEEL can help reduce your costs . . . increase your production . . . and improve the performance of your products.

Typical ARMASTEEL castings

Because of the greater physical properties of GM 86M ARMASTEEL, it was possible to redesign this anchor plate as shown and effect a weight reduction from 2.26# per piece to 1.44# per piece.

GM 86M ARMASTEEL provides the ideal casting for this automobile differential case because of its high strength, minimum deflection and good damping qualities which contribute to quietness of operation. Note the as-cast internal cavity and the well-formed webs.



GM 85M ARMASTEEL provides a crankshaft with more desirable machining characteristics than a forged crankshaft of SAE 1045 steel. Improves machining of journals and reduces checking stock. Use of GM 85M ARMASTEEL made possible the redesign of the crankshaft with a resulting 3.5# weight reduction and a lower material cost.

By converting to GM 85M ARMASTEEL, drilling and boring operations were eliminated on this crankshaft sprocket. Stock in rough part was reduced from 1.93# in forging to 1.00# in casting. Customer realized reduced piece price with GM 85M ARMASTEEL.

GM 84M ARMASTEEL was specified for this socket plate journal because its microstructure makes it more easily machined than steel with the same physical properties. It has better bearing and wear resistance qualities . . . less distortion during machining . . . and does not require heat treatment. Weight of part in rough is less than comparable steel forging.

Crankshaft for newly designed small gasoline engine. GM 84M ARMASTEEL specified because of outstanding success in similar engines. Less stock removal and better machinability are advantages over forged crankshaft.

This planet gear carrier was formerly forged from SAE 1141 steel, which required a heat treatment after rough machining and broaching operations. By converting to GM 88M ARMASTEEL, heat treatment was eliminated and the weight of the rough part was reduced.

By converting to GM 88M ARMASTEEL for this universal joint yoke, hole thru hub could be cast in . . . eliminating a drilling operation and reducing weight of part approximately 30%. GM 88M ARMASTEEL part has lower piece price than forging formerly used.

85

GENERAL MOTORS CORPORATION • SAGINAW, MICHIGAN • DEPT. 24

7 great lapping machines for your profit-boosting

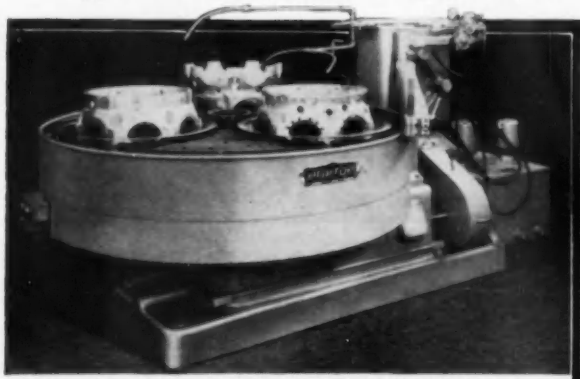
"TOUCH of GOLD"

If you are performing single or parallel face flat lapping operations you'll get real profit-boosting qualities from the ability of these machines to improve your product quality — shorten production time — lower your lapping costs. In other words — from their ability to give you the "Touch of Gold".

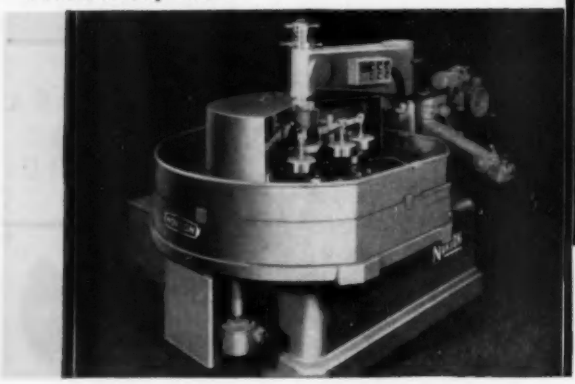
With NORTON HYPROLAP* machines you'll lap fast — and get clean work on which you can do further machining without cleaning operations — because their bonded abrasive laps leave your parts free of imbedded grit. The hydraulically operated truing devices on these machines provide additional advantages in assuring truth of lap face — plus the convenient means of quickly changing lapping action by rough or fine truing of the lap by simple adjustment of the speed of the truing arm.

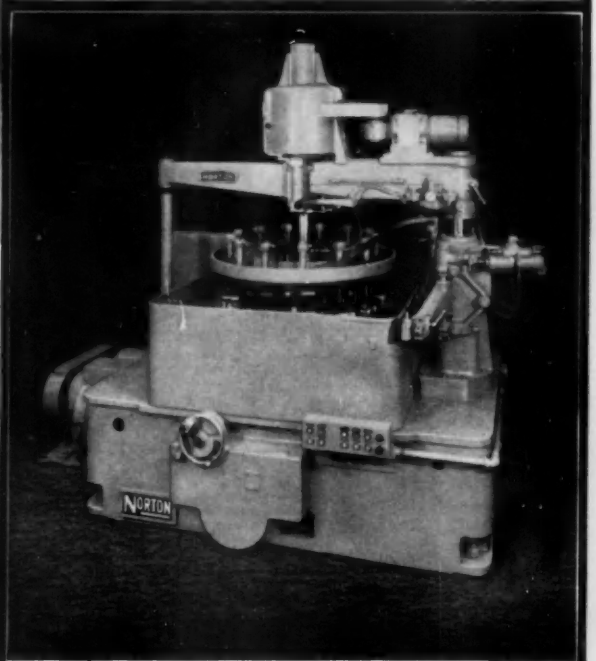
For operations requiring cast iron laps, you will get continuing high investment return — and steady, low cost production from the #16-FC and #28 Lapping Machines — because of their simplicity of operation — and outstanding durability. They'll operate steadily for you with minimum attention or maintenance — hour after hour — day after day.

For further facts see your Norton representative or write direct. And remember: only Norton offers you such long experience in both grinding machines and grinding wheels to help you produce more at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Massachusetts.

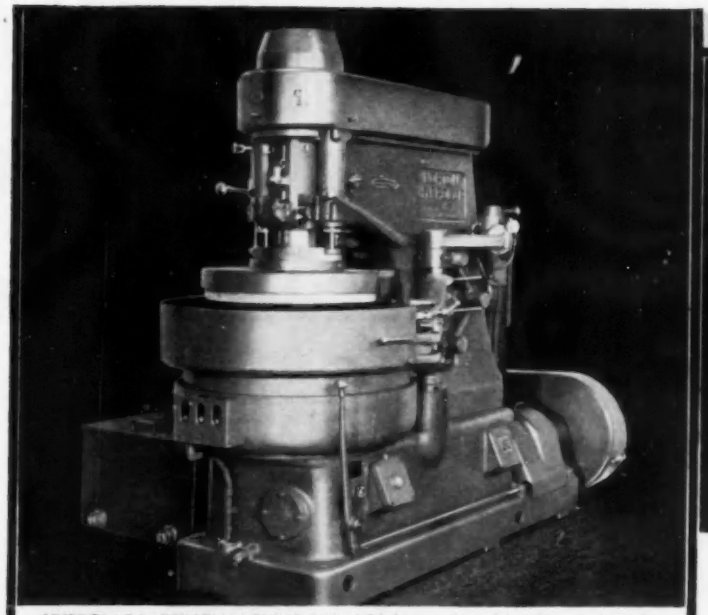


HYPROLAP SINGLE FACE FLAT LAPPING MACHINES #60-F (above) and #36-F (below). Sensational performers using bonded abrasive laps and filtered coolant. Provide clean seal surfaces, wear surfaces or reference surfaces for further machining. Available for small or large production lots: plain timed cycle; automatic continuous feed or semiautomatic continuous feed. Rigid power-operated truing arm insures true flatness of abrasive lap and finished work pieces. Heavy or light parts handled with equal ease.



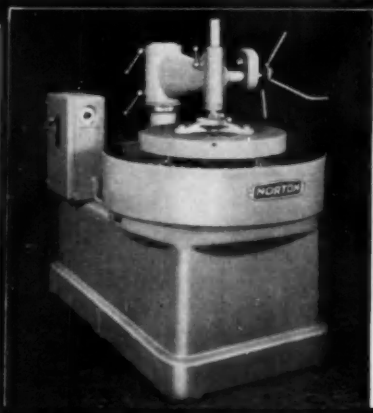


HYPROLAP SINGLE OR PARALLEL FACE FLAT LAPPING MACHINE #48-F. Similar to the #60-F and #36-F Lappers in speed and accuracy, with provision for parallel face flat lapping. For single face flat lapping the machine mounts a single 48" diameter bonded abrasive lap. For lapping opposed parallel flat surfaces an upper lap is added. Arrangements: plain timed cycle; automatic continuous feed or semiautomatic continuous feed.



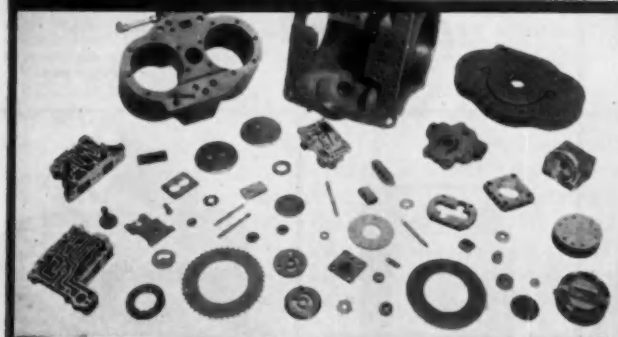
HYPROLAP LAPPING MACHINE #26. A high speed machine for two face flat lapping or cylindrical lapping that finishes up to 100 or more work pieces simultaneously. Lapping pressure is hydraulically powered and controlled — an exclusive Norton development. Arrangements: plain timed cycle; automatic continuous feed or semiautomatic continuous feed. Like other HYPROLAPS, lap truing is hydraulically powered and controlled.

HYPROLAP LAPPING MACHINE #12-F. For small, parallel face flat lapping. Ideal for small ball bearings. Arrangements: plain timed cycle; automatic continuous feed or semiautomatic continuous feed. All three provide fast efficient lapping with selective speeds for laps and work-holders, permitting positive selection of ideal speeds for each job. Cleanliness of finished work surfaces eliminates the need for cleaning operations.



PLAIN TIMED CYCLE LAPPING MACHINE #28. Produces flat or cylindrical surfaces to extremely close tolerances and high degree of finish. Uses cast iron laps with loose abrasive. An attachment for cylindrical lapping is furnished with the regular flat lapping arrangement. For plug gage or gage block tolerances the machine is unsurpassed. An arrangement for hand lapping with 36" or 40" cast iron laps is also available.

PLAIN TIMED CYCLE LAPPING MACHINE #16-FC. An outstanding performer for flat or cylindrical work, such as Diesel injector parts, plug gages, size blocks, sides of rings and short cylindrical parts. Using cast iron laps with loose abrasive it produces optically flat surfaces to extremely close thickness tolerances. Its fine repetitive accuracy helps reduce inspections and eliminates the need for selective assembly.



NORTON JOB LAPPING SERVICE. Improve your product quality by precision lapping. The Norton Job Lapping Department, complete and modern in every detail, is ready to finish jobs to your exact specifications. Flat or cylindrical lapping operations handled quickly to your tolerance specifications. Parallel face flat lapping is our specialty. See your Norton representative or write direct.

To Economize, Modernize with **NEW**

NORTON

GRINDERS and LAPPERS

Making better products... to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels
Grinding Machines • Refractories

BEHR-MANNING PRODUCTS: Coated Abrasives
Sharpening Stones • Behr-cat Tapes

*Trade-Mark Reg. U.S. Pat. Off. and Foreign Countries

District Offices: Worcester • Hartford • Cleveland • Chicago • Detroit — *In Canada:* J. H. Ryder Machinery Co., Ltd., Toronto 5.

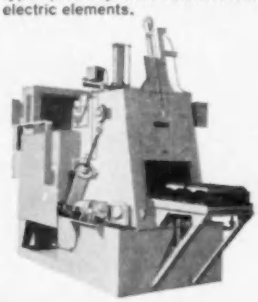
Wherever industry needs heat...

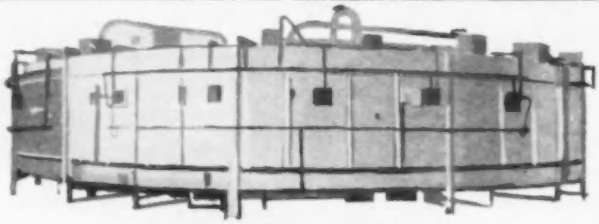
You'll find LINDBERG equipment just right for the specific job

Pilot Plant Equipment: Atmosphere tube unit (shown) for processing work at temperatures to 2200° F.

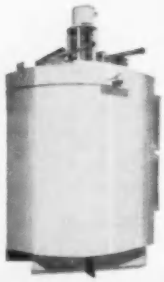
Roller Hearth Furnaces: Continuous electric type (shown) with temperature range 1300° to 2100° F.

Automatic Carbonitriding Furnaces: Automated integral quench type (shown) with CORRTHERM electric elements.





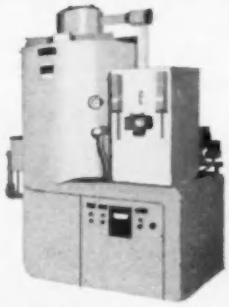
Rotary Hearth Furnaces: Doughnut type field-installed gas-fired furnace (shown) with capacity of 13,000 lbs. per hour.



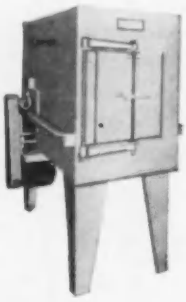
Vertical Type Furnaces: Carburizing and hardening furnace (shown) with CORRTHERM electrical heating elements.

HF Induction Heating Units: Available in 5, 10, 25 and 50 KW units.

Ceramic Kilns: Gas-fired periodic kiln (shown) with temperature range to 3250° F.

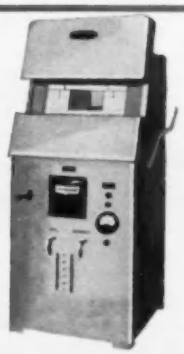


Atmosphere Generators: Hyen generator (shown) for endothermic atmospheres. Generators for all required atmospheres.

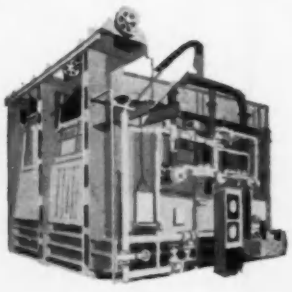


Tempering Furnaces: Box type Cyclone (shown). Temperature range to 1250° F.

Melting and Holding Furnaces: Electric resistance furnace (shown) with capacities of 750 lbs. to 1500 lbs.



Laboratory Equipment: One-unit box furnace (shown), muffle or for non-oxidizing atmosphere with temperature range to 3000° F.



Aluminum Reverberatory Furnaces: Twin-chamber melting and holding furnace (shown) with 45,000 lbs. capacity.

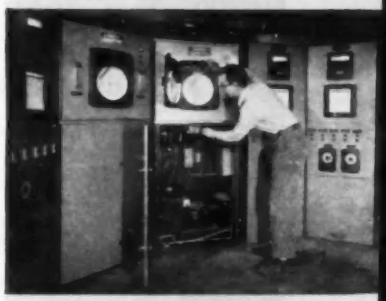
Charles Hewitt, President of Dayton, says, "The Lindberg installation has kept our production at a consistently high quality level."

Work loads are positioned manually, but entire furnace operation is fully automatic.

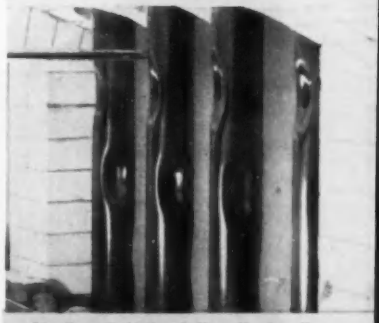
Unique Installation Cuts Heat Treating Costs and Improves Quality at Dayton

Here is a remarkable set-up for general heat treating now in operation at Dayton Forging & Heat Treating Company, Dayton, Ohio. Two integral quench atmosphere furnaces, largest of this type ever built by Lindberg, and one atmosphere tempering furnace in a "three-in-a-row" arrangement that simplifies transfer operation. Combined with Lindberg Carbotrol and Hyen generator, the entire furnace operation is completely automatic, including atmosphere control and recording. Planned by Dayton and Lindberg engineers, the installation runs around the clock, six days a week, reducing costs and producing cleaner end products, brighter job finish, freedom from "decarb" and a consistently higher quality of work.

This is another example of how Lindberg equipment and Lindberg planning can help you find the most effective answer to any problem of applying heat to industry. We cover the field, heat treating, melting and holding, tempering, brazing, enameling furnaces, ceramic kilns, high frequency units, and are in the ideal position to recommend just the type of equipment most suitable for your needs. This can be factory built or field-installed in your own plant, fuel-fired or electric, whatever is best suited to your production processes. Consult your local Lindberg Field Representative (see the classified phone book) or get in touch with us direct. Lindberg Engineering Company, 2491 West Hubbard Street, Chicago 12, Illinois. Los Angeles Plant: 11937 S. Regentview Avenue, at Downey, California.



Lindberg Carbotrol unit automatically controls and records "dew point" and heating cycles of endothermic atmosphere.



Lindberg's "dimple" vertical radiant tubes give remarkably trouble-free service and function at all times at full efficiency.

LINDBERG heat for industry

Circle 124 on Inquiry Card for more data

CALENDAR

OF COMING SHOWS AND MEETINGS

Cycle and Motor Cycle Show, Earls Court, London .....Nov. 15-22

National Plastics Exposition, Chicago, Ill. .....Nov. 17-21

National Conference on Air Pollution, Sheraton-Park Hotel, Washington, D. C. .....Nov. 18-20

Ninth National Conference on Standards, Hotel Roosevelt, New York .....Nov. 18-20

Manufacturing Chemists' Association, 8th semi-annual meeting and winter conference, Hotel Statler, New York City .....Nov. 25

First Electronic Computer Exhibition, London .....Nov. 28-Dec. 4

American Society of Mechanical Engineers, annual meeting, Statler and Sheraton-McAlpin Hotels, New York ....Nov. 30-Dec. 5

2nd National Symposium on Global Communications, St. Petersburg, Fla. .....Dec. 3-5

Industrial Engineering Conference, sponsored by Illinois Institute of Technology, at Illinois Institute of Technology, Chicago, Ill. .....Dec. 4-5

Smithfield Show and Agricultural Machinery Exhibition, Earls Court, London .....Dec. 8-12

125th Annual Meeting of the American Association of the Advancement of Science, Washington, D. C. .....Dec. 26-31

1959

49th Annual National Motor Boat Show, New York Coliseum, New York, N. Y. .....Jan. 16-25

Chicago Automobile Show, International Amphitheatre, Chicago, Ill. .....Jan. 17-25

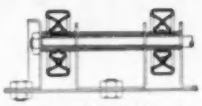
Institute of Aeronautical Sciences, 27th annual meeting, Sheraton-Astor Hotel, New York, N. Y. Jan. 26-29

Plant Maintenance & Engineering Show, Public Auditorium, Cleveland, O. .....Jan. 26-29

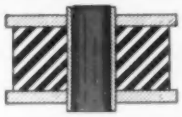
5th Annual Midwest Welding Conference, sponsored by Armour Research Foundation and Chicago Section of American Welding Society, at Illinois Institute of Technology, Chicago, Ill. .....Jan. 28-29

First International Symposium on Nuclear Fuel Elements, sponsored by Columbia University and Sylvania-Corning Nuclear Corp., at Columbia University, New York, N. Y. .....Jan. 28-29

F-M Spacers Save Money in Hundreds of Applications. Spacers shown in Red



Cross member dividers on conveyor sections.



Motor mount bolt sleeve spacer.

Control rod spacers.

Before and after: Two spacers replace undercut machined wheel hub

Leaf spring bolt spacer.

Spacer-stabilizer linkage.

SAVE

Time, Money, Materials with Rolled, Split SPACER TUBES

Spacers can effect savings in many manufacturing and assembly operations—from automobiles to pull toys, phonographs to corn pickers. Furnished to your exact dimensions, ready to assemble, they are an economical substitute for iron pipe, tubing or machined parts; eliminate costly cut-off and de-burring machine time; save on secondary operations such as slots, holes, notches and chamfers. In steel, aluminum and stainless. Plain or plated. Many lengths, diameters and wall thicknesses. Complete engineering service.

FREE design data book on standard and special spacer specifications. Address:

FEDERAL-MOGUL DIVISION

FEDERAL-MOGUL-BOWER BEARINGS, INC.
11037 SHOEMAKER, DETROIT 13, MICHIGAN

FEDERAL Mogul

RESEARCH • DESIGN • METALLURGY • PRECISION MANUFACTURING

GVW vs PAY-LOAD

WHERE A POUND SAVED IS A DOLLAR EARNED!

By saving dead weight, vacuum power can add several hundred pounds to pay-load, and earn extra dollars, as ton-miles build up.

In addition there is vital safety in having physical braking instantly available should power fail for any reason.

For these and other important reasons, vacuum power is the overwhelming choice on trucks, and HYDROVAC* leads all other makes combined.

...It will pay you to look into

HYDROVAC (VACUUM HYDRAULIC) POWER BRAKING BY BENDIX

*REG. U.S. PAT. OFF.

Bendix PRODUCTS DIVISION South Bend, IND.

Bendix AVIATION CORPORATION

Circle 127 on Inquiry Card for more data

AUTOMOTIVE INDUSTRIES

High Spots of This Issue

▼ Automating Crankshafts

All V-8 engines for Ford's M-E-L Div. are made in the new Lima, O., plant, one of the most modern in the industry. Because of the plant's size, this article deals only with two engine components—crankshafts and piston pins—plus a few highlights on cylinder block and piston quality control. Page 48.

▼ SAE Aeronautic Meeting

What's new in missiles, rockets, and aircraft? This report on the SAE Aeronautic Meeting, held each year in Los Angeles, tells you what some of the top men in the industry are thinking. Page 56.

▼ French Cars Show Trend to Italian Styling

Two trends in French cars are noted in this report on the 1958 Paris Automobile Show: one is the influence of a new European body style, created chiefly by Italian designers; the other is the use of components made in other countries. Page 58.

▼ Demand for Economy Affects Engine Trends

Now that the 1959 car models are in dealers' showrooms, it is possible to summarize the major changes in the engine picture. The current status of the six-cylinder engine, four-barrel carburetors, compression ratios, fuel injection, and other design features are discussed here. Page 60.

▼ Gear Housing Machined in One Cycle

A modified Greenlee transfer machine is being used to machine the 1959 power steering gear housing manufactured by Saginaw Steering Div., GMC. Operation of the machine, which handles about a ton of housings at one time, is described here. Page 66.

▼ 41 New Product Items And Other High Spots, Such As:

Studebaker-Packard new line of trucks; executive earnings; American Body Engineers meeting; trend in construction equipment industry; and industry statistics.

A new problem facing steel users today

The danger of losing money by relaxing inventory controls

When the slump set in last year, big inventories were one of the toughest problems for most companies.

Now, as the economy swings back, these problems may seem to have disappeared. Actually, the problems of inventory cost and risk are always with us—just as much a threat to profit in good times as in bad.

But with the urgency of strict economies reduced, there is a very real danger that many companies will be caught off guard—a danger that recession-born practices will be abandoned as temporary emergency measures without careful enough analysis of their profit potential.

For example, companies that modified their steel inventory policies to avoid long-term commitments found that many costs were reduced and their needs better served. By taking advantage of the stocks offered by steel-service centers, these companies were able to release working capital for more productive purposes, free valuable storage space, reduce handling costs and lower scrap losses, insurance, taxes, etc.

Proof in dollars and cents

Those who carefully weighed all the advantages found reason for a *permanent* modification of their previous buying practices. They proved to themselves that they could and should rely much more heavily on steel-service centers because it makes sense in dollars and cents.

This conclusion is especially sound when you consider the unusually broad scope of Ryerson stocks and the speed and dependability of Ryerson services. Any kind, shape and size of steel can be shipped to you from Ryerson in a matter of hours. And your steel can be furnished in ready-to-use form, saving time and initial-cutting cost. You gain complete flexibility to meet quick shifts in production schedules. And you have the added assurance of getting steel of uniform, high quality—the unequalled dependability of Ryerson *certified* quality.

Your Ryerson representative is well qualified to review the facts and help you get the maximum value for your steel buying dollars. Ask him to analyze your requirements with you the next time he calls.

What it costs to carry inventory

IRON AGE magazine says: "*A survey of eight plants shows that, for every $100 worth of materials bought, the average yearly inventorying cost is $19.37.*"

Other authorities say the real cost of steel placed in inventory for extended future use may be as high as 40% more than the invoice price.

RYERSON CERTIFIED QUALITY

RYERSON STEEL®

Member of the INLAND Steel Family

***Principal Products:* Carbon, alloy and stainless steel—bars, structurals, plates, sheets, tubing—aluminum, industrial plastics, metalworking machinery, etc.**

JOSEPH T. RYERSON & SON, INC. PLANTS AT: NEW YORK • BOSTON • WALLINGFORD, CONN. • PHILADELPHIA • CHARLOTTE • CINCINNATI • CLEVELAND DETROIT • PITTSBURGH • BUFFALO • INDIANAPOLIS • CHICAGO • MILWAUKEE • ST. LOUIS • LOS ANGELES • SAN FRANCISCO • SPOKANE • SEATTLE

News

OF THE AUTOMOTIVE AND AVIATION INDUSTRIES

Vol. 119, No. 10 **November 15, 1958**

Car Plants Go on Overtime To Make Up Lost Production

Plants around the automobile industry went on overtime, extra shifts and Saturday work in late October to make up production lost during the early-month strikes at assembly and supplier plants.

The last UAW strike against GM was settled when Fisher Fleetwood workers in Detroit agreed to return to their jobs. Fleetwood supplies Cadillac, which was perhaps the hardest-hit of all GM divisions. Cadillac normally works a second shift, and catch-up production is difficult to schedule.

Buick scheduled a second shift of 3300 men in all of its productive operations except final assembly. The assembly rate, however, was boosted to clean up the backlog of 80,000 dealer orders, described as the largest since the immediate post-war period.

Division general manager E. T. Ragsdale said it would take more than three months to build a normal dealer inventory. Buick was able to ship only 26,000 1959 models before the 15-day strike hit GM.

Ragsdale, incidentally, said the first 100,000 new car orders ran about 50 per cent for the LeSabre, 29 per cent for the Electra, and the balance for the Invicta series.

At Ford Div., all 13 final assembly plants worked the last Saturday of October to relieve some of the pressure of new car orders. At month's end, every Ford Div. plant was working at least nine hours a day, with seven plants working 10-hour days and two other plants operating a full second shift.

Division head J. O. Wright said the daily production level of 5400 units was being increased. Engine plants were operating 20 hours a day to meet new demand for six-cylinder engines.

NEW FERRARI 250 HAS PININ-FARINA BODY

The new Ferrari 250 with body by Pinin-Farina is powered by a V-12 engine that develops 240 bhp at 7000 rpm. Compression ratio is 8.5 to 1. Car is built on a 101.5-in. wheelbase, and weighs 2640 lb.

Ford Div., not as hard hit as Plymouth and Chevrolet, was able to deliver 6861 cars on introduction day, while a total of about 27,000 sales were recorded.

At Chrysler Corp., Plymouth Detroit assembly plant was working a second shift, and five corporation plants scheduled Saturday work to boost output. The six-day schedules covered Plymouth, Dodge, De Soto and Chrysler assembly operations.

Both American Motors and Studebaker-Packard were upping their production rates. AMC scheduled 7142 units for the final week of October, with six days of two-shift operation.

AMC set a daily record for its Kenosha assembly plant Oct. 28 when 1444 units were built.

Rambler deliveries in the first 20 days of October totaled 15,889 units, compared with 9680 for the entire month of October a year ago, according to AMC.

Studebaker-Packard was working nine-hour shifts in South Bend, including Saturdays. The company slated nearly 3000 units for the final week of October, highest of the year.

Further schedule increases are anticipated. Chevrolet, for instance, expects to climb back to the 40,000 weekly rate it maintained during many of the final weeks of 1957. Other makers, although they may not keep up the overtime pace, will keep their daily schedules high.

Transaxle to Make Bow On 1960 Model Cadillac

The much-discussed transaxle will make its first appearance on the 1960 model Cadillac next fall.

The transaxle, or combination transmission and rear axle, is considered the answer to the troubling question of what to do with the hump in the floor of the modern passenger car.

Other automobile companies, notably Chrysler Corp., have been working on transaxle development, but Cadillac apparently will be the first on the scene. Chrysler is expected to

INTERNATIONAL HARVESTER BUILDS NEW VAN-TYPE TRUCK

International Harvester recently unveiled this new lightweight van-type truck which it describes as the smallest multi-stop delivery vehicle produced by an American manufacturer. Called the Metro-Mite, the vehicle is powered by a new four-cylinder, 51-hp engine, weighs 2800 lb, and features unitized construction. It is rated at 3800 lb gvw and has a payload capacity of 1000 lb. Wheelbase is 96 in; overall length is 159 in.

follow in 1961, and perhaps some other GM divisions will join.

Mounting the transmission on or next to the differential housing will eliminate the floor pan hump under the dashboard and a tunnel through the center of the floorboard. Or, at least, it will reduce the size of the hump and tunnel considerably, allowing more leg room for passengers.

Since the transaxle will do away with the Hotchkiss drive, Cadillac will adopt some form of a swing axle. Division engineers have been working with three types, including the De Dion and full swing, but probably will settle on a split axle similar to the one used on the Mercedes 190.

Cadillac, incidentally, should have little problem with the floor hump on 1960 models, since the new "low silhouette" Hydra-Matic also is being readied for production.

Chrysler Executive Reveals Position on Small Car Design

Recent statements by a Chrysler executive may indicate that the corporation has some general details worked out for its proposed small car.

Byron J. Nichols, group vice-president, said Chrysler is continuing its development work "in order to be ready for market opportunities and competitive situations which might arise."

Nichols said the "ideal American-built small car" will have the engine placed forward. It would have a somewhat longer wheelbase than the typical European small car and would be "big enough to carry five people comfortably with room for their luggage."

It would also have adequate power and acceleration, he said, to hold its own on American superhighways.

GM reportedly has settled on a rear-mounted engine for its proposed vehicle. Ford, although a rear engine was considered in the early stages, now has settled on a front-mounted powerplant.

Wheelbase of all three projected cars, incidentally, ranges from 108 to 111 in., according to the latest word.

So far, none of the Big Three has denied progress on small car programs. But neither has any of the companies stated definitely that the small cars under development ever will see the inside of a dealer showroom.

Just in case the momentous decision should be made, however, the companies must include tentative target dates with their development plans so that schedules can be met. And these dates, of course, are subject to change.

General Motors is shooting for public introduction in the fall of 1959, Ford after Jan. 1, 1960, and Chrysler sometime during the 1960 model year.

"Building Block" Concept Endorsed by Manufacturers

The "building block" concept of standardization of machine tool components has been endorsed by representatives of manufacturing, according to Henry C. Daum, manager of Ford Motor Co.'s machining process department.

Standardization allows one or more sections of a production line to be replaced with other standard sections adapted to new production requirements.

Daum has been serving as chairman of an industry committee to study standardization of dimensions and specifications for machine tool heads, bases and other components. Summer meetings with machine tool companies

ATLAS VAN

Standard Motor Co. of Coventry, England, entered the light truck field with this Atlas half-ton panel van. The cab-over-engine model with separate chassis is powered by a 35-hp unit used in small Standard cars. Steering design gives a tight 29-ft turning circle with an 84-in wheelbase. Body has a cargo volume of 180 cu ft.

produced early recommendations; October meetings with manufacturing firms exposed the concept to users' study.

The program aims to reduce obsolescence costs, allow frequent model change with low tooling costs, and perhaps more important, permit smaller manufacturers to purchase automatic production equipment.

GM's New One-Body Concept Aims at Annual Model Change

General Motors' new one-body concept, introduced with 1959 passenger car lines, points to the annual model change of which GM is the new self-styled champion.

All five GM cars are new for 1959, and all five will have new styling for 1960 and probably for 1961 as well. This is the annual model change which past and present GM presidents Harlow H. Curtice and John F. Gordon have praised as a vital economic stimulus.

Fisher Body Div. said the new concept of body construction will provide the kind of design change that previously was possible only in a two or three-year cycle.

A Fisher Body spokesman told AI that it "no longer is necessary to make all new inner body components to completely restyle for the next model year." He said the new method involves inner and outer body components, with similarities among certain inner components.

The inner components were not named, but it is believed they include under body, header assembly, rocker panels, pillars, cowl and toeboard assembly, and rear wheel housing and quarter panel.

Windshield and back light frames are similar.

Adjustments can be made lengthwise, but the width of GM's new cars is set by the under body and header assembly. Maximum width of every current GM production sedan and hardtop model is 79.0 in. at the center pillar, excluding hardware and molding.

This is the basic inner body which Fisher Body said is entirely functional and adds strength and rigidity to the structure. And this is the shell which the five division styling departments are using for developing their own models.

Each division engineers its own chassis, but the chassis must mate with the riggers of the common under body.

The outer skin of sheet metal carries the styling theme, particularly in fenders, rear deck and hood. Outer door panels can be sculptured or given other individualistic treatment, but the door openings are determined by pillar location.

Cutouts in the under body, toe board, and dash panel sheet metal accommodate various transmission, pedal, and instrument panel requirements.

Other changes can be made by Fisher Body to suit each division's specifications, but the inner body remains basically unaltered in design.

The huge retooling program that took place this year will be "economically sound" in the long run, according to Fisher Body, since all new inner body components will not be needed from year to year. A sizeable savings should be realized just in extended use of costly fixtures for the inner body assembly.

MASERATI

Maserati's new sports car, the 200 SI, is powered by a 121.7-cu in., four-cylinder engine which develops 190 bhp at 7200 rpm and has a compression ratio of 9.5 to 1. Car is built on an 86.6-in. wheelbase.

MAICO 700

Maico 700 Sport, a German-built car, will be distributed in U.S. through Maico Motor Co., Detroit. Car is powered by a 30-hp, 3-cylinder engine mounted in the rear. Other features include four forward speeds, synchro-mesh transmission, and independent coil-spring suspension. Car is built on 84-in. wheelbase, and has overall length of 147 in. Maico will list at $1845 at port of entry.

DELIVERY TRUCK POWERED BY V-4 AIR-COOLED ENGINE

Montpelier Model 75 delivery truck, built by Montpelier Mfg. Co., is claimed to be the first vehicle of its kind designed primarily for use with V-4 air-cooled gasoline engine. Powered by a Hercules CV4-180 unit rated at 70 hp, the new vehicle has a GVW of 6000 lb and a 250 cu ft cargo compartment. Other features include a new unitized body assembly; a front-end bogie assembly for engine, transmission, clutch, and front axle; reinforced fiberglass roof with translucent panels; and fiberglass body panels.

News AUTOMOTIVE AND AVIATION

LIFTER-TIPPER

This 30-ton vehicle called a lifter-tipper picks up and moves 24-ft lengths of concrete pipe weighing 90 tons each. Vehicle is 53 ft high, 31 ft wide, and has a front wheel base of 30 ft, 6 in. It is powered by a hitch-on D-8 Caterpillar tractor. Supporting all this weight are twelve 14.00 x 24 tires made by B. F. Goodrich Tire Co. Vehicle was built by United Concrete Pipe Corp., Baldwin Park, Calif.

New Delco Shock Absorber Replaces Air with Freon

A new Delco Products shock absorber, in use on some 1959 GM cars, uses Freon 13 sealed in a pliable nylon bag instead of conventional air cells.

The new unit, called Pliacell, is immersed in the shock absorber fluid and expands and contracts with the movement of the shock absorber piston.

Separation of the fluid and Freon 13, according to Delco Products Div., eliminates aeration and sludging of fluid. It also permits better valving regardless of mounting position.

Hot Metals Contracts Promise Bright Future for Aluminum

Hot metals contracts that guarantee a steady supply of aluminum are helping aluminum producers in their battle for the automobile market.

The long-term contracts call for uninterrupted delivery of molten aluminum from the producer's reduction plant to the automobile company's foundry. Side by side location of the two plants makes it possible to transfer the hot metal to the foundry with little heat loss.

This eliminates two steps — ingot casting by the reduction plant and remelting by the foundry—so that the user can cast the alloys directly.

This has encouraged automobile companies to speed work on aluminum components that previously were considered out of reach. A good example is Chevrolet's aluminum engine, which will be produced soon after Chevrolet begins receiving molten aluminum from Reynolds Metals Co. in Massena, N. Y.

Aluminum use in the automobile industry has jumped considerably in recent years, and is expected to go much higher. From 1955 to 1959 model years, the average poundage of aluminum in passenger cars increased from 30 to 57, according to Reynolds.

The number of functional applications went up from 318 to 344 with production of the new model cars, Reynolds reports, and the number of decorative applications increased from 127 to 185.

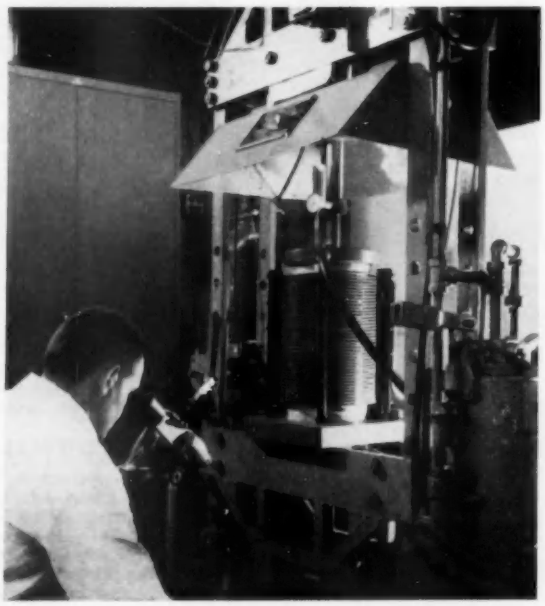
Reynolds expects automobile industry consumption to double every five years, reaching an average of 500 lb per car by 1980.

Reynolds will begin delivering molten aluminum to Chevrolet from its Massena plant next May. Production is expected to reach an annual rate of 200 million lb by August. Capacity will be about 240 million lb a year.

Chevrolet expects to pour its first test castings at Massena in June or July. How much molten aluminum Chevrolet will absorb has not been determined, although it will represent a large percentage of Reynolds' output.

Reynolds also supplies GM's Fabricast Div. on a similar basis at Jones Mills, Ark., and Ford Motor Company at Sheffield, Ala. The Ford contract calls for 640 million lb of aluminum over a 10-year period.

Molten aluminum also is going to smaller parts manufacturers who supply many of the components purchased by all of the automobile companies.



CERAMIC TEST FACILITY

Ceramic materials are being tested in completely integrated Westinghouse laboratory at East Pittsburgh, Pa. Equipment consists of three basic units: a power supply, a hot press, and a vacuum furnace. Shown here is the hot press on which forming and sintering are performed simultaneously. Press has a 60-ton capacity.

THERMAL FATIGUE TEST MACHINE

This test machine automatically heats and cools alloys to help International Nickel Co. engineers learn more about the effects of thermal shocks on metals. A Leeds & Northrup Co. radiation pyrometer solves the problem of measuring temperatures. Metallurgist is shown using an L&N portable optical pyrometer to spot check the recorded temperature of the Inco alloy sample. Machine is located in Inco's Bayonne Research Laboratory.

Wettlaufer Joins Pioneer In New Engineering Firm

Wettlaufer Engineering Corp. has merged with Pioneer Engineering & Manufacturing Co. and from now on will operate as a separate division of Pioneer. The two Detroit firms specialize in industrial and product engineering, particularly automotive.

In the transaction, Pioneer bought all of Wettlaufer's assets. Pioneer already operates Douglas Tool Co. as a division similar to the new Wettlaufer setup.

Michael Pinto continues as president of Pioneer and Elmer Wettlaufer, president and founder of the purchased company, joins the Pioneer board of directors.

Champion Spark Plug Opens Research Center in Toledo

Champion Spark Plug Co., has opened a million-dollar research and engineering center in Toledo, O., adjecent to the company's main plant.

Champion president R. A. Stranahan, Jr. says the new facilities are the "largest and most modern in the world" for testing and developing spark plugs.

The two buildings in the new center cover 35,000 sq ft and contain separate mechanical, engine, electronics, and chemical laboratories and machinery development section. Also included are test cells for aircraft, outboard, automotive and small engines.

AI TABLOID

Westinghouse Electric Corp. previewed its newest atomic research tool — the Westinghouse Testing Reactor—which is scheduled to go in operation next May. WTR's primary purpose: to test materials and nuclear fuels under conditions like those encountered in an operating power reactor.

* * *

Aluminum Co. of America developed a new technique for irregularly shaped aluminum products that cannot be handled by mechanical stress relieving methods. The new method relieves internal stresses by superimposing a system of thermal gradients opposite to those which created the stresses during the quenching operation.

* * *

Piper Aircraft Corp. is studying the market potential for a two-place sport, business, and training plane priced at "well under $5000." The new plane, dubbed Papoose, will be a compact, low-wing craft with tricycle landing gear and a 90 or 100-hp engine.

* * *

Du Pont Co. is producing limited quantities of a new insulating material in the 1300 to 2100 F. range that it says is about twice as effective on a volume basis as any known material of its type. The new material, called fibrous potassium titanate, is composed of a compact mass of crystalline fibers that block heat penetration by scattering infrared rays.

* * *

Timken Roller Bearing Co. announced plans to build a new plant in Colmar, France, to produce tapered roller bearings for the French market. Scheduled capacity: 8 million bearings a year.

* * *

Westinghouse Electric Corp. has a new ultrasonic transducer that it says gives twice the usable ultrasonic power for the same electric input as do conventional units. The new design consists of laminations spaced in a sort of latticework across the transducer plate, with each lamination working as a driving element in unison with all the others to vibrate the plate in piston-like fashion.

Recessed surfaces are easier and less costly to nickel plate with anodes cast as a new low-sludge alloy, says Hanson-Van Winkle-Munning Co. The new material, called Lo-Sludge Nickel Anodes, corrodes evenly with a minimum of metallic and carbon sediment and without the use of anode bags.

* * *

Armour Research Foundation is working on a new technique for continuous, chipless forming and cut-off of cylindrical metal components. ARF expects to come up with a small high-speed unit similar to an automatic screw machine that will turn out high-volume items such as needle bearings, rivets, and lock pins.

* * *

Electric Storage Battery Co. opened a new research center that will seek new and better forms of packaged power. Current projects: hermetically sealed storage battery cells, which will never need watering; and new types of cells that will convert light and fuel to electrical energy at high rates of efficiency.

* * *

A Russian work, first published in 1957, on the possibilities of using atomic energy in aircraft and rockets has been translated by the Air Force and published by the Office of Technical Services, U. S. Dept. of Commerce.

* * *

Industries Kaiser Argentina, an affiliate of Willys Motors, Inc., announced it has manufactured 31,000 motor vehicles in less than 30 months of operation. The total includes 14,000 Jeep ¼-ton units, 3000 Jeep trucks, 13,000 Jeep station wagons, and 1000 Carabela passenger cars.

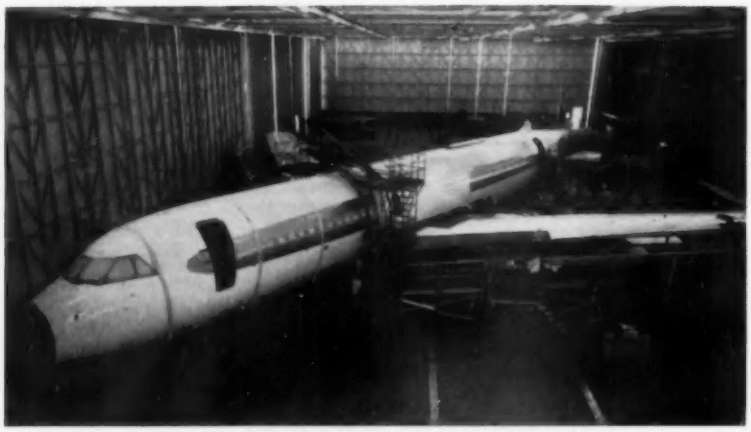
* * *

General Motors contributed more than $647,000 toward high school driver education programs during the 1957-58 school year. GM dealers donated 5182 new cars for school use during the year.

* * *

Bryant Gages and Surface Plates has moved headquarters from Springfield, Vt. to the Ex-Cell-O plant in Greenville, Ohio. Ex-Cell-O acquired Bryant Chucking Grinder Co. earlier this year.

AVIATION MANUFACTURING



CONVAIR 880 MAJOR MATE COMPLETED

Major mating of the forward fuselage section of the first Convair 880 jet transport was completed at San Diego Plant I, Convair Div. The 800 assembly line starts with mating the two halves of the swept wings, after which a center fuselage section is added. Major mate for the airplane is in two steps. First, the entire aft fuselage is mated to the wings and center section; then, the forward fuselage section is mated to the ship. The 880 is scheduled to fly early next year.

New Superconductors Discovered By Westinghouse Electric Corp.

Westinghouse Electric Corp. scientists have uncovered a new family of uranium compounds that may revolutionize the practices and products of the electrical and electronic industries.

The new compounds belong to a group of substances called superconductors that permit electric currents to flow through them in undiminished strength, "apparently forever," according to a Westinghouse scientist.

The new superconductors were discovered by Dr. B. S. Chandrasekhar, physicist in the Westinghouse Research Laboratories, and Dr. J. K. Hulm, manager of the Laboratories' solid state physics department.

The superconductors were found during research on the electrical properties of uranium alloys at temperatures less than one degree above absolute zero—459 degrees below zero on the Fahrenheit scale.

The new superconductors, four in all, include two that contain manganese and iron, thus upsetting a widely held theory that the presence of these two elements is hostile to superconductivity.

In explaining superconductivity, Dr. Hulm said that for reasons not now well understood, the electrical resistance of various metals and alloys subjected to very low temperatures suddenly drops to about one-millionth of one-billionth of its normal value, with the result that "electric currents flow in them undiminished and apparently forever."

"One can readily visualize the immense practical importance of this behavior if it could be made to occur at reasonably high temperatures," Dr. Hulm added. "Such superconductors would make possible electrical and electronic devices not now even visualized, and would revolutionize the practices and products of these industries as we know them today."

Dr. Hulm noted that superconductors are beginning to find application in midget computers for airborne control of rockets and missiles.

New British Instrument System Lands Planes Automatically

A new aircraft landing system that not only controls an aircraft during an instrument approach, but also automatically completes the "flareout" and touchdown has been developed by the Royal Aircraft Establishment of the British Ministry of Supply.

The new system consists of a combination of the standard instrument landing system using radio beams to control altitude and azimuth, and magnetic cable guidance system that takes over when the aircraft reaches an altitude of 70 ft.

Two magnetic cables, just below ground level, are located on both sides of the approach runway. Equipment aboard the aircraft measures the changes in magnetic fields and automatically guides it toward the centerline with a reported accuracy of better than five feet.

A control mechanism coupled with a radio altimeter maintains speed and rate of descent, and gradually closes the throttles during flareout.

Over 2000 successful landings with piston engine and jet aircraft have been accomplished with the system in a variety of weather conditions, according to the Supply Ministry.

Republic Gets AF Contract To Probe Aircraft Coatings

Republic Aviation Corp. has received an AF study contract to investigate coatings for aircraft and missile skins.

The contracts, for $135,000, calls for an evaluation of the abilities of the coating to radiate heat at the high temperatures (up to 2400 F) encountered in Mach 5 speeds.

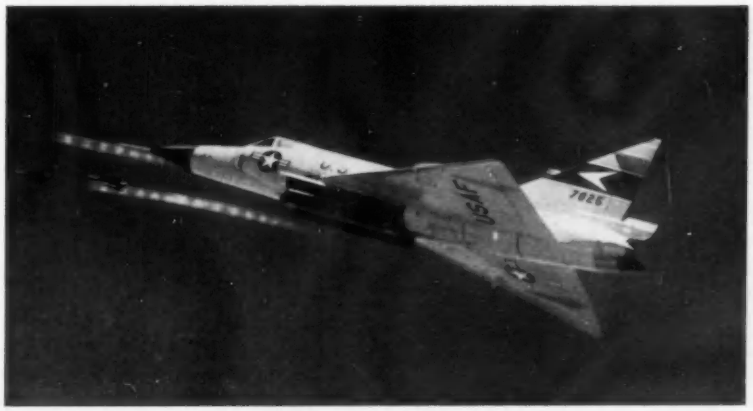
Republic said it will use such metals as Iconel X, forms of high-strength steel, and a new titanium alloy to find coatings that can dissipate such heats. The contract will run through 1959.

New Vanguard Launch Stand Installed at Cape Canaveral

Martin Co. has installed a new launch stand on the Vanguard pad at Cape Canaveral, Fla., which will allow rockets to be fired in winds up to 38 mph velocity.

Launchings from the old stand had to be postponed in winds over 22 mph, the company said.

The new stand features four "retractable" arms about 4 ft long. These arms replace the "flip-away" arms used on the old launching stand and lessen the danger of hanging up the rocket during the critical first few seconds of the launch, Martin said.



F-102 FIRES MISSILE SALVO

The supersonic F-102 launches a salvo of Falcon guided missiles at jet-powered drone targets. Demonstration took place at the USAF World-Wide Weapons Meet at Tyndall AFB, Fla., last month. The Falcon missile and armament control system were developed by Hughes Aircraft Co.

The launch stand weighs 4298 lb (about 25 per cent lighter than the old stand) and rests on the original launch platform. It was designed and built by Martin Co.

High Explosives Shape Airplane Fuel Tanks

High explosives are used to form aircraft fuel tanks at the Columbus Div. of North American Aviation, Inc.

North American engineers developed the technique, called explosive forming, to make wing-tip fuel tanks for the Navy T2J jet trainer. The tank, made up of two sections, is about 12 ft long.

To form the tank, a cone-shaped sheet of metal—about 1/16-in thick—is placed inside the die and the die filled with water. The air between the cone and the sides of the die is pumped out to create a vacuum.

The high explosive is then fired inside the cone. The water acts as both a force conductor and shock dampener.

North American engineers explained that the new technique is simply a way of using explosive force to push metal against a containing die of the desired shape.

Explosive forming is also being used to swage tubing around plug-end fixtures. This application, the company said, is an example of compressive or "implosive" effect, whereby the tube is formed into the groove of the plug to which it must be attached.

Columbus Div. said it is planning a production explosive forming facility. Parts and dies will be wheeled down inclined rails into a water-filled pit. The forming charge will automatically fire when the tool and part are in position.

Missile Projects and Awards Hit Record High, AMRI Says

Missile contract awards and new project announcements set a record in recent months, according to the Association of Missile & Rocket Industries.

New programs include the Air Force Rover rocket and the Falcon GAR-9 atomic missile, the Navy's Hopi rocket, Raven air-to-surface missile, and Vigilante anti-missile missile.

Army contracts awarded recently include $135 million to Western Electric for continued development of the Nike-Zeus; $30 million to Hughes Aircraft for a missile monitor defense system, and $1.4 million to Martin for the Pershing IRBM.

The Air Force also awarded Bendix $12 million for a weather reconnaissance system and picked Boeing Airplane Co. out of 17 contenders for the Minuteman ICBM.

AMRI's Missile Salesman's guide lists these and other awards in its October supplement to the regular June issue. Altogether, more than 140 missile projects since World War II are outlined, plus the missile work of more than 50 prime contractors.

A further supplement will cover more than 200 leading subcontractors in the missile field.

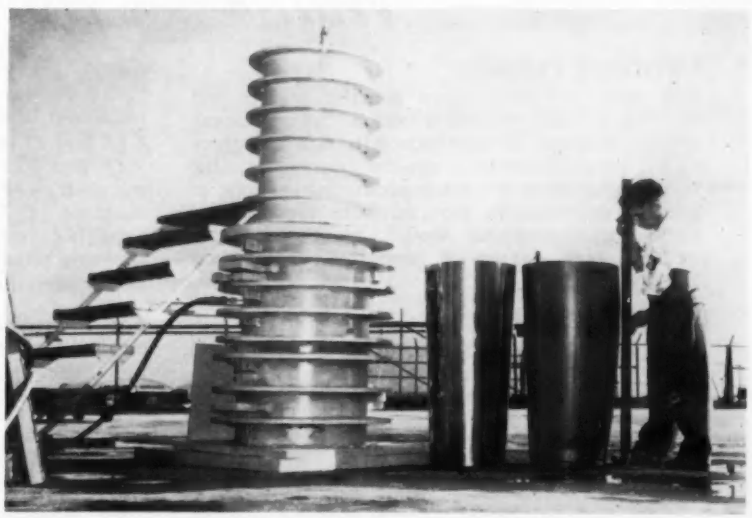
New Jet Utility Plane Ordered Into Production by Air Force

North American Aviation, Inc., announced that its twin-jet utility plane, the Saberliner, has been ordered into production by the Air Force.

The quantity of planes ordered was not made public, but Raymond H. Rice, North American vice-president, said it is expected that the production program would "extend over a considerable number of years."

The plane, designated T-39, is powered by two General Electric J-85 turbojet engines.

The T-39 carries a crew of two and four passengers, but it can be modified to carry an additional four persons, the company said.



North American engineer holds straight edge along finished part of explosively formed tank section for T2J jet trainer. Cone blank from which tank section is formed is in center. At left is die in which part is formed.

CASE HISTORIES

Two precision ball bearings, one concentric within the other, are periodically rotated in alternating directions during operation—thus reducing random drift to 0.25 degree per hour.

Photo: courtesy Sperry Gyroscope Co.

1,200% Gain In Gyro Accuracy With N/D Ball Bearings

CUSTOMER PROBLEM:

Get new, advanced gyro bearing design "off the board" and into production. Sperry Gyroscope Company, in developing its new Rotorace (TM) gyro, designed a special bearing capable of "averaging out" error-producing effects of friction on sensitive gyro gimbals. New manufacturing techniques would be required to achieve high degree of precision required by Sperry design.

SOLUTION:

N/D Engineering, when approached by Sperry, created special manufacturing techniques for the high precision production of these unique piggy-back gimbal ball bearings. Used in the Rotorace design, the bearings helped achieve reduction of the gyro's random drift rate. The 2 or 3 deg. per hour drift, recently considered very good, is now cut to as little as 0.25 deg. per hour, with still lower rates in sight. Another example of New Departure's ability to meet exacting instrument bearing requirements through broad engineering experience and precision manufacturing techniques.

For immediate engineering analysis of your current high precision instrument and miniature ball bearing problems, write New Departure, Department C-11.

NEW DEPARTURE

DIVISION OF GENERAL MOTORS, BRISTOL, CONN.

NOTHING ROLLS LIKE A BALL

Circle 129 on Inquiry Card for more data

MEN IN THE NEWS

Scovill Mfg. Co.—Seldon T. Williams was elected president and general manager, and Garvin A Drew was appointed general manager of the Schrader Div.

Timken Roller Bearing Co.—Herchel M. Richey was elected vice-president, manufacturing, of Roller Bearing and Rock Bit Divs., and R. G. Wingerter was made general manager of Automotive Div.

Purolator Products, Inc.—Justus P. Nesbitt has been named manager of manufacturing, and Robert L. Ditter, production control manager.

Clearing Machine Corp.—**David W. Bonnar** has been appointed sales manager of Torc-Pac presses.

Midland-Ross Corp., Owosso Div.—**Edmund Moran** was promoted to manager of distributor operations; **Fred Peacock**, service manager; and **Ward Brigham**, sales office manager.

Skinner Chuck Co., Electric Valve Div.—**William J. Bloudek** was named sales manager, and **Anders Anderson**, sales office manager.

Capewell Mfg. Co.—**Royal A. Wilson** has been named Michigan district manager.

Firestone Tire & Rubber Co.—**Richard H. Mather** was named vice-president in charge of production of the Firestone International Co.

Chrysler Corp.—**A. B. Nielsen** was made executive assistant to the group vice-president, automotive sales; and **William J. Bird** was named assistant general sales manager, general sales office.

International Nickel Co., Inc.—**Albert P. Gagnebin** was elected as a vice-president and **Joseph M. Weldon** as an assistant vice-president.

Lindberg Engineering Co. — **Ray P. Dunn** was appointed technical director of the Melting Furnace Div.

General Motors Corp., Allison Div.—**E. M. Deckman** was appointed assistant manager, sales and contracts, of Aircraft Engine Operations; **Norman E. Eggers**, manager of commerical sales; **Richard L. Coffey**, manager of military sales; **Harry H. Bolton**, contract administrator for military sales; **Donald D. Davis**, assistant manager of commercial sales; and **Walter O. Higgins**, manager of subcontract sales.

National Acme Co. — **Stanley E. Casson** is now director of sales.

Republic Gear Co.—**Steven S. Gordon** has been elected president.

Chrysler Corp.—**Lynn A. Townsend** was elected group vice-president, international operations.

Cleveland Punch & Shear Works Co.—**William J. Stewart** was elected president.

Borg-Warner Corp., York Div.—**Emil Peslar** has been made vice-president and general works manager of the Grantley Works, and **S. S. Meadows** was appointed vice-president and general manager of the Decatur operations.

American Motors Corp., Automotive Div.—**Stanley W. Wasil** was promoted to national business management manager.

Ford Motor Co.—**Duane D. Freese** has been named a full member of the Dealer Policy Board; **F. J. Spittle**, secretary; and **Felix T. S. Admas**, analysis manager of the board staff.

General Motors Corp., Central Foundry Div.—**Leon F. Corp** was promoted to assistant divisional manufacturing manager, and **Arthur J. Karam** to plant manager of the Saginaw Malleable Iron Plant.

Simmonds Aerocessories, Inc.—**Geoffrey R. Simmonds** was elected president.

Joseph T. Ryerson & Son, Inc.—**C. Nelson Wetherell** was made manager of the systems and procedures division.

Bendix Aviation Corp.—**J. M. Miller** has been named director of engineering for the Missile Section.

Hall-Toledo, Inc.—**John Kozak** was named chief engineer.

Budd Co.—**Philip W. Scott** has been elected a group vice-president.

Borg-Warner Corp.—Donald R. Spotz was elected president and general manager of Pesco Products Div. and Wooster Div.

Ramsey Corp.—William S. Mahoney was elected president.

Necrology

Raymond R. Britton, 70, retired purchasing agent of the Toledo plant of Dana Corp., died Oct. 24.

William E. Crawford, 60, a retired director of research and engineering at the A. O. Smith Corp., died Oct. 22, at Berlin, Wis.

Walter E. Lyon, 55, director of tire engineering and development of Firestone Tire & Rubber Co., died Oct. 4, at Akron, O.

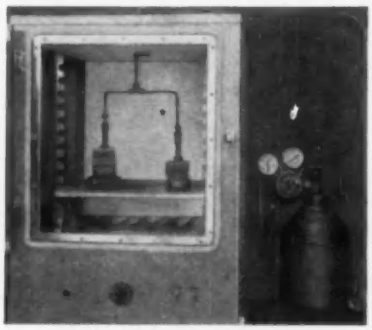
Technical data for gasket design and selection

NUMBER SEVEN

Choosing a gasket for service under high heat, high loads

Where gaskets are used under conditions that combine elevated temperatures and high flange loads—as for example in compressor heads and automatic transmissions—problems of extrusion and torque loss are likely to be met.

If internal pressures are also high, or if contained fluids or gases may attack the gasket—as in refrigeration



Laboratory test checks the combined effect of refrigerant gas and high temperature on Accopac AN-890. Flange at left contains refrigerant at 130 psi; flange at right contains no gas. After initial torquing at room temperature, flanges were heated to 300° F. and torque measured at 24-hour intervals for one week. Test showed no loss of torque on AN-890.

compressors—the service conditions become even more critical.

A new beater-saturated asbestos gasket that will seal under these rigorous conditions has been developed by Armstrong research. It is Accopac AN-890, a blend of refined asbestos fibers and nitrile-type rubber.

AN-890 withstands temperatures up to 800° F. and will not crush or extrude under test loads of 100,000 psi at 300° F. It has unusual torque retention and sealing properties in applications where heat, high flange loads, and high internal pressures are involved.

AN-890 is one of the Armstrong line of Accopac materials. It is available in rolls, sheets, or die-cut parts. For more information, write for a copy of our folder IND-915.

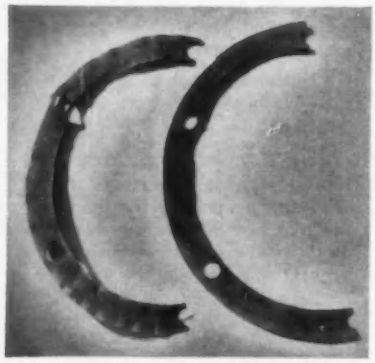
How contained fluids affect the choice of resilient gasket materials

When selecting a resilient gasket material, the possibility of undesirable interactions between the gasket and the contained fluid should be an early consideration.

The action of sealed fluids on a gasket takes two basic forms: *deterioration* and *shrinking or swelling*. Deterioration may result either in leaks or in contamination of the contained fluid. Shrinkage of a gasket, of course, ultimately results in leakage.

Within limits, swelling is not an undesirable reaction in a gasket. In fact, moderate swell can help create a more effective seal since it reduces the minimum flange pressure required for sealing. For example, Armstrong Accopac N-820 requires about 2,000 psi when sealing oil, but will seal a mixture of ethylene glycol and water at flange pressures of around 1,000 psi.

In judging the effect of fluids on a gasket, it is best not to rely on immersion tests of uncompressed samples. Porous materials, which absorb



These gaskets were used to seal hot oil. Ordinary plant fiber material (left) dried out and shrank. Armstrong Accopac gasket (right) was practically unaffected.

rather large amounts of liquid when unconfined, have radically different swelling characteristics when compressed. (See test photo at right.)

The effect of contained fluids can be controlled to some extent by proper design. Such things as bolt load, flange rigidity, and operating temperature should be considered along with the internal environment of the gasket. The maintenance of adequate flange loads, for example, will reduce the risk of fluid getting into the gasket or into the interface between the gasket and the flange.

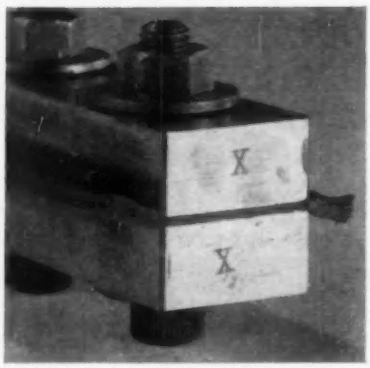


Photo shows difference in swell characteristics of fiber gasket. Test flange was immersed in gasoline. Gasket under compression remains at original thickness; unconfined material at edges swells to over twice original thickness.

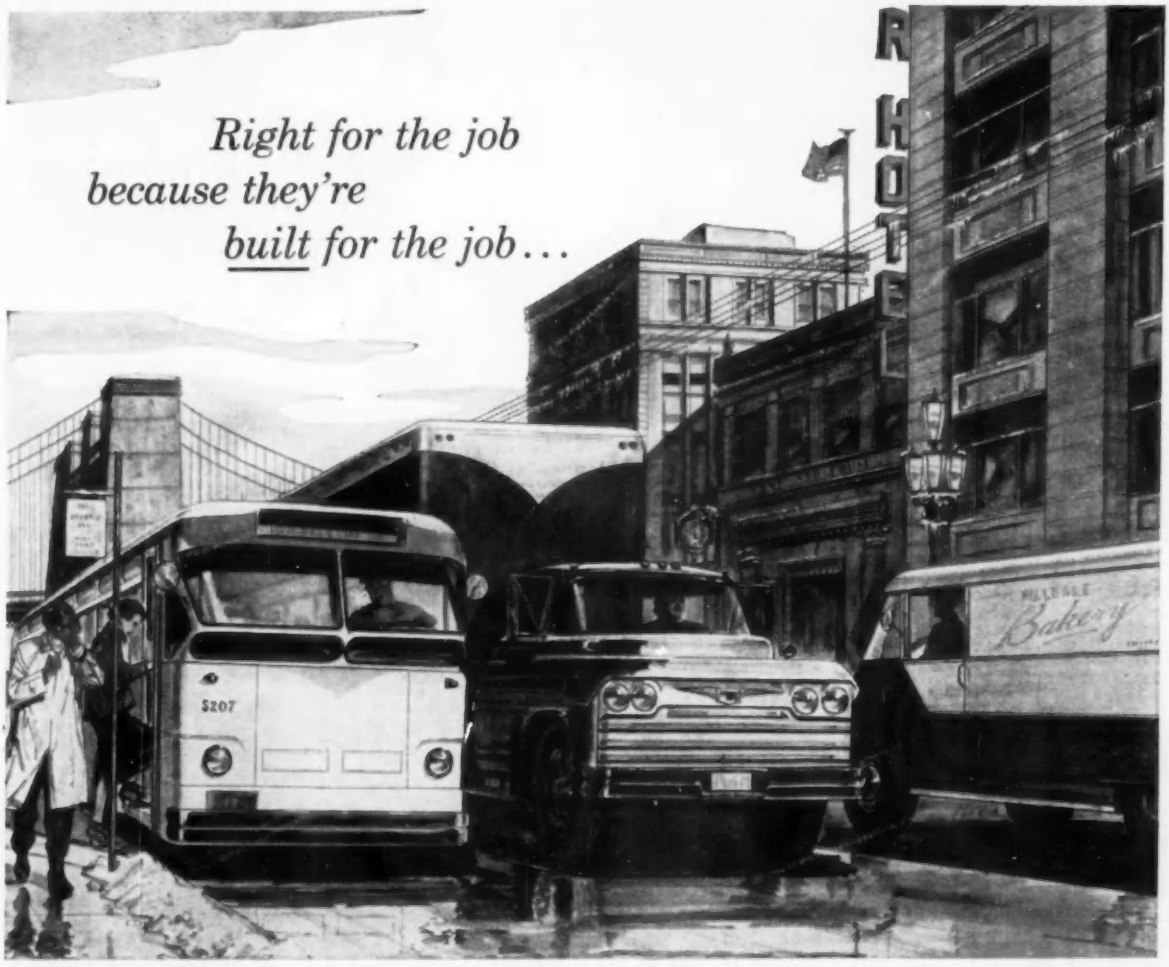
Information on the effect of contained fluids on specific classes of gasket materials is contained in the Armstrong Gasket Materials catalog. Data on design factors related to gasket selection is available in the new Armstrong Gasket Design Manual. Write for your copy of either—or both—of these books today.

For your copy of Gasket Materials catalog or new Gasket Design Manual, write to Armstrong Cork Company, Industrial Div., 7111 Imperial Avenue, Lancaster, Pa.

Armstrong GASKET MATERIALS

. . . used wherever performance counts

Right for the job
because they're
built for the job...



EVANS HEATERS ARE RIGHT FOR TRUCKS BECAUSE THEY'RE BUILT FOR TRUCKS

Evans heaters . . . designed specifically for trucks and buses . . . are built for heavy-duty operation.

An Evans heater keeps the driver comfortable with a continuous flow of fresh, warm air. It also provides ample defrosting, keeping the windshield and side windows clear at all times.

Evans heaters do a better heating job because they provide both high BTU ratings and proper heat distribution. Without proper heat *distribution*, high BTU ratings are meaningless.

Evans heaters are custom-built to meet your individual requirements; each is backed with a parts "repair or replace" warranty good for a full year or 50,000 miles, whichever occurs first.

EVANS PRODUCTS COMPANY
PLYMOUTH, MICHIGAN

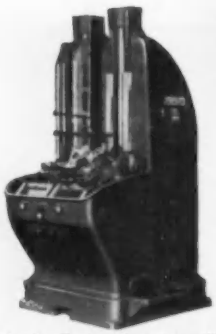
Whatever your truck heating problem, our engineers will be happy to help you solve it. Write for full information to Evans Products Company, Dept. P-11, Plymouth, Michigan.

Regional Representatives: Cleveland, Frank A. Chase
Chicago, R. A. Lennox Co., Inc.; Detroit, Chas. F. Murray Sales Co.
Allentown, Pa., P. R. Weidner

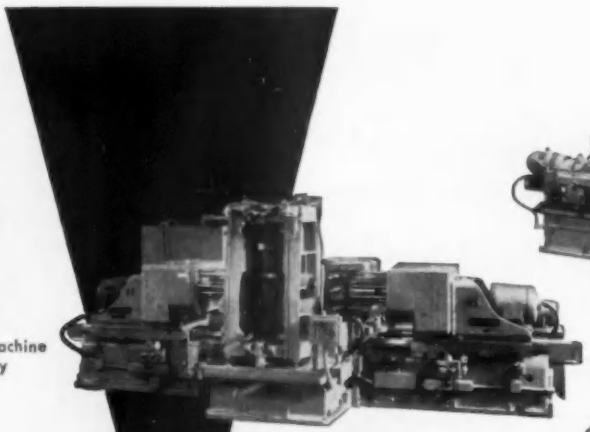
EVANS PRODUCTS COMPANY ALSO PRODUCES:

railroad loading equipment; bicycles and velocipedes; "Evanite"® fir plywood; fir lumber; "Evanite"® battery separators; Evanite hardboard®; "Haskelite"® building panels, Plymetl® and doors; Evanite Plywall®

Circle 131 on Inquiry Card for more data

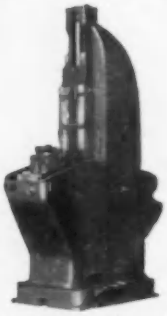


Duplex Surface Broaching Machine
5, 10, 15 and 25 Ton capacity

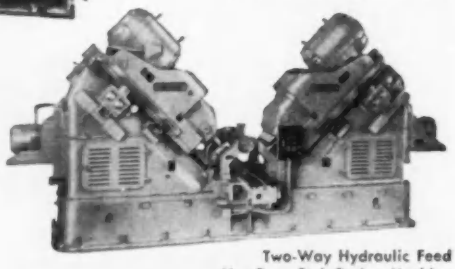


Three Way, 63 Spindle Central System Type, Hydraulic Feed, Horizontal Drilling and Boring Machine with Hydraulically Operated Fixture in Loading Position

Station Type Machine Having 27 Stations, 139 Spindles for Processing a V Type Automobile Motor Cylinder Block



Single Slide Broaching Machine
5, 10, 15 and 25 Ton capacity



Two-Way Hydraulic Feed
Vee Type Stub Boring Machine

FOOTBURT

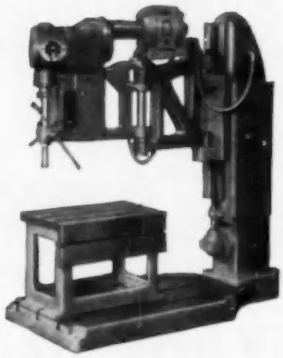
line of production machines

1, 2, 3, 4 and 6 Spindle
Sensitive Drilling Machines

Way Type Drilling, Boring, Reaming, Tapping and Milling Machines with One, Two or More Ways . . . Station Type Machines . . . Center Column Type Machines . . . Cylinder Boring Machines . . . Inverted Drilling Machines . . . Surface Broaching Machines . . . Sensitive Drilling Machines . . . Hammond Radial Drilling Machines . . . Hammond Surface Grinding Machines . . . Manufacturing Type High Duty Drilling Machines . . . Independent Feed Drilling Machines . . Special Machines.

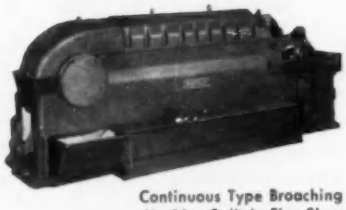
THE FOOTE-BURT COMPANY, Cleveland 8, Ohio

Detroit Office: 24632 Northwestern Hwy., Detroit 35, Mich.



Unique Bracket Type Hammond
Radial Drilling and Tapping Machine

Extremely accurate
Hammond Tool
Room Grinder



Continuous Type Broaching
Machine Built in Five Sizes

ENGINEERED

FOR

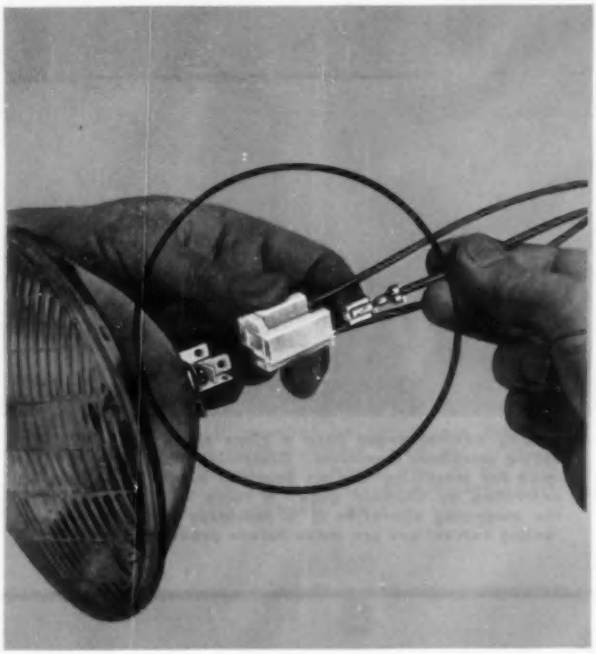
PRODUCTION

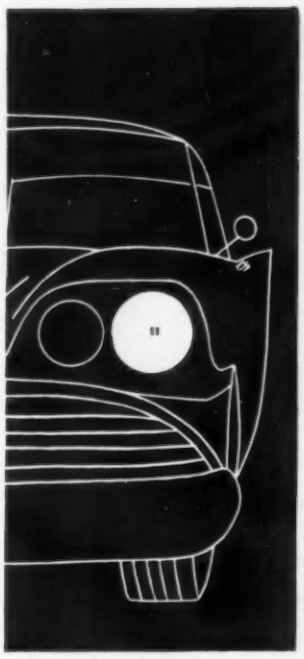
Write for Catalog

FOOTBURT

MACHINE TOOLS

IT'S A SNAP . . .





THE AMP FASTIN-FASTON SAVES TIME AND MONEY ON YOUR SEALED BEAM HEAD LAMP CONNECTIONS

The new A-MP FASTIN-FASTON snaps onto sealed beam head lamps with a thrust of the fingers. For two or three tabs. The FASTIN-FASTON obsoletes all other connectors, ends inspection rejects, saves on installation time and costs while assuring uniform quality.

FASTIN-FASTON housing made of Cycolac for excellent dielectric characteristics.

Tab receptacles self-lock in housing . . . offer highest electrical values and rugged, vibration resistance. Compression crimp for maximum conductivity.

No auxiliary parts or accessories.

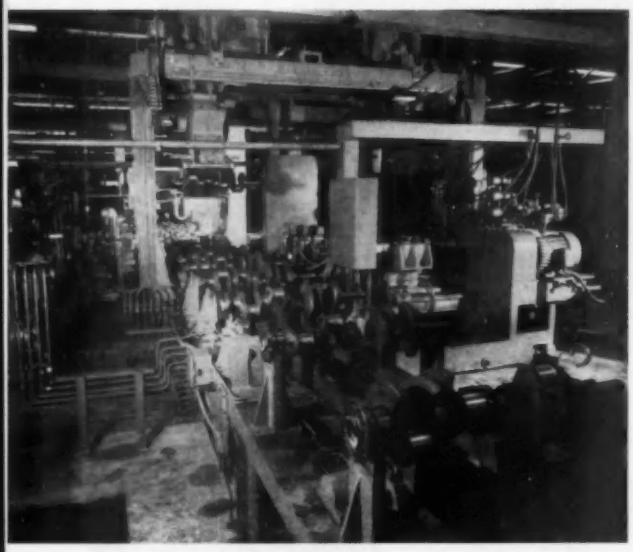
Unvarying performance and lower cost . . . a snap for the all new A-MP FASTIN-FASTON.

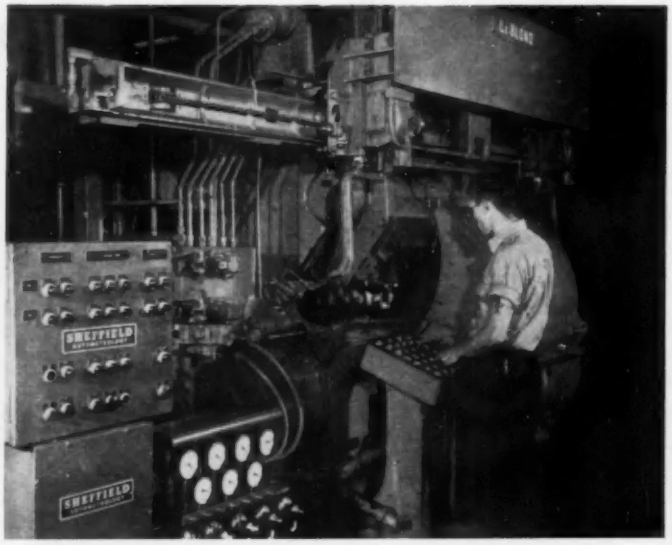
For more information, write today.

AMP INCORPORATED

GENERAL OFFICES: HARRISBURG, PENNSYLVANIA

A-MP products and engineering assistance are available through subsidiaries in: Canada • England • France • Holland • Japan





CRANKSHAFT PRODUCTION

A series of five machines are tied together by transfer devices to perform finish-machining operations on crankshafts. As the crankshafts move through the Sundstrand machines, automatic loaders pick them up and place them into machining positions.

Quality control gages keep a close check on crankshafts during machining processes. Completely-automatic LeBlond lathe for machining the pin bearings on the crankshaft is controlled by Sheffield gage. If there is any variance in the machining operation it is indicated on the gage and tooling corrections are made before production is resumed.

Automating Crankshafts and Cold-Extruding Piston Pins

By Joseph Geschelin

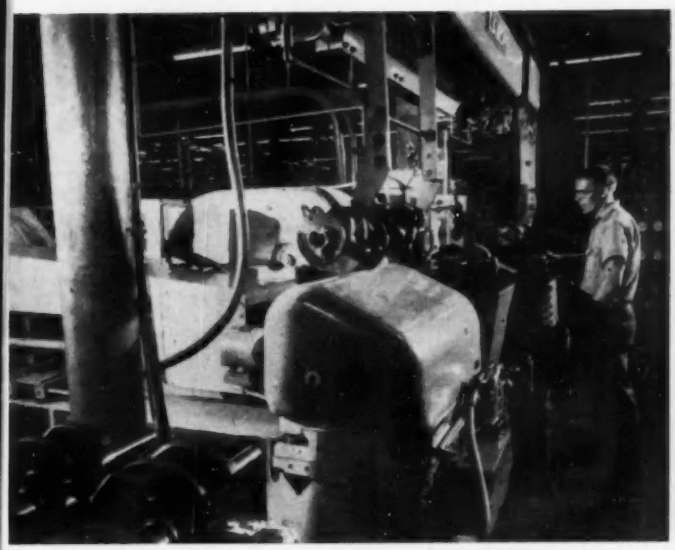
ALL V-8 engines for M-E-L Division, Ford Motor Co., are being produced in the Lima (Ohio) engine plant, latest in the Ford program and one of the most advanced operations of its kind in the industry. It was unveiled publicly in August, 1958, permitting industrial editors to view the plant and tell their readers about it for the first time.

Since this plant packs an enormous amount of equipment and process in the one-million square feet of floor space, we have confined this article mainly to coverage of two interesting components—crankshafts and piston pins—and have added some highlights on cylinder block and piston quality control.

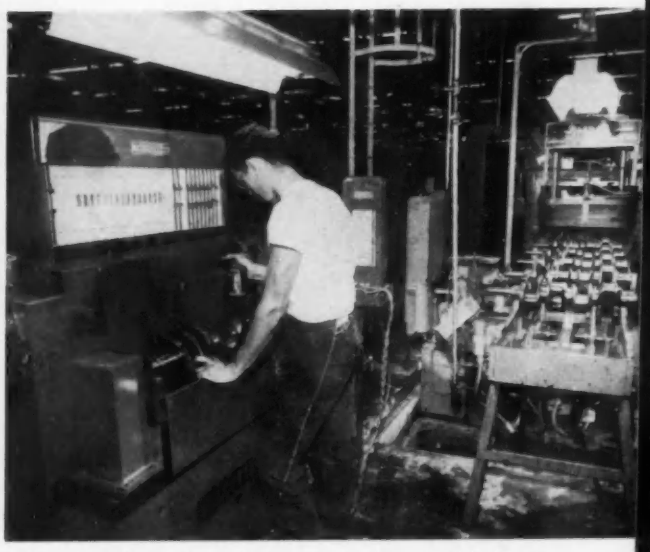
Machining of the shell-molded crankshaft is noteworthy and should be of general interest, for many reasons. For one thing, the Lima crankshaft department may well be the most highly mechanized in the industry. Automatic loading and unloading of LeBlond crankshaft lathes is no longer new, to be true. But in this department even the Landis grinders are completely automated—with automatic loading and unloading, as well as automatic pick-up and return to feeder conveyors—and the same is true of the remaining equipment in use here.

In short, crankshafts move through the major operations practically without manual handling of any kind. Nor is this the whole story. Sheffield column gages are employed at various machines to verify critical dimensions, and this gaging is also automatic. Moreover, the gages exercise control over the machine in the event that tolerances are exceeded. In the case of the Landis grinders, the machine will be shut down if any diameter—on the five-wheel machine, for example—is out of tolerance.

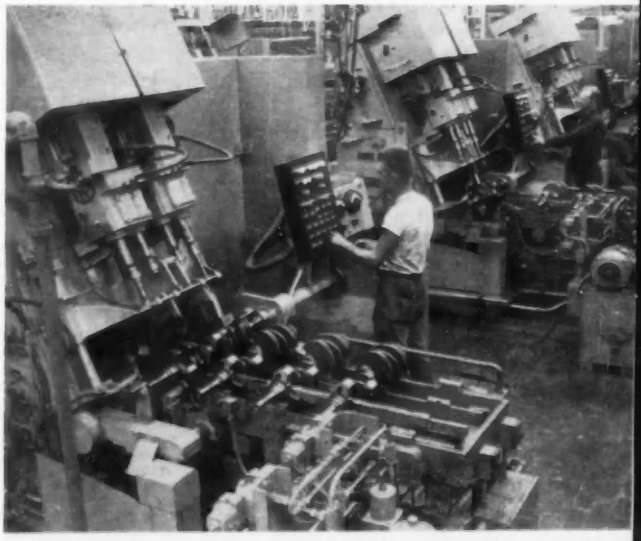
Crankshaft balancing has been elevated to highly precise operation with the introduction of a battery of Tinius Olsen electronic balancing machines. Hitherto unheard of commercial tolerances can be maintained for several reasons, all stemming from the design of the new equipment. In the first place, the balancing machine and the sensitive balance drilling station are an integral unit, a feature Ford has used for years. The balance cradle is right in the drilling station, eliminating the usual practice of transferring the work from the balance



Automatic loading and unloading operations are features of the multiple-wheel Landis grinder, used for grinding crankshaft main bearings. This marks one of the first attempts in the automobile industry to grind the crankshaft on a fully-automatic machine.



Thirty-two critical dimensions of an engine crankshaft are gaged simultaneously and automatically on a Sheffield air-operated visual gage. Although the crankshafts are checked at practically every machining operation, they receive a final dimensional check while being rotated on the gage.



Crankshafts for Edsel, Mercury, Lincoln and Continental engines are automatically balanced on Tinius-Olsen electronic balancing machines. The machine, which is automatically loaded, determines how much the crankshaft is out-of-balance and where the unbalance is located, and then drills counterweights to give proper balance.

cradle to the drilling station. This accounts for one major element conducive to holding fine tolerances. The other is that the T-O electronic balancing machine has been vastly improved and is capable of almost fantastic precision. For example, the present setup will balance and balance-drill to a tolerance of 0.3 oz-in. in regular production. Ford people believe they can come even closer if it is necessary.

Crankshaft Machining

Following receiving inspection, crankshafts enter the first station on the machine line for milling both ends square and to length; center drilling both ends; and milling the driving and locating notches. This is done in Sundstrand rise-and-fall transfer type milling and drilling machines. High-speed-steel center drills are employed throughout.

Shafts now are ready for machining operations. It is important to note that with the improvements that have been effected in foundry practice, the shafts are produced so close to dimensions and rough tolerances that turning operations have been materially reduced. Only two LeBlond operations are required in preparation for grinding. Similarly, the counterweights are cast so true to size that no turning or checking is necessary.

First LeBlond operation is on the main bearing line. This includes the following steps: rough and finish-turn five main bearings; oil seal diameter; post diameter; flange and hub OD; sprocket shoulder diameter; face and chamfer both sides of flanges; rough-face both sides of oil slinger; finish-turn oil slinger OD.

The operation is fully automatic. The LeBlond automatic loading device picks up the part from the Automation conveyor at the side, while the other arm of the loader removes a finished crank from the work station and transfers it to the Sheffield gaging station. All of the tooling is cemented-carbide.

The second LeBlond operation is that of rough and finish-turning of

PISTONS AND PINS

This is the first step in the cold extrusion process used for production of piston pins. The Danly 500-ton press, shown here, can produce over 1900 piston pins hourly.

Pistons are individually graded for size, weight and taper in a temperature-controlled room. Employees mark the pistons so they may be precision-fitted into cylinder bores, which also have been graded and marked.

diameters and widths on four pin bearings. This operation is performed in PBA LeBlond Duplex automatic pin-turning lathes, handling two crankshafts at a time. Automation in this instance is designed to handle two parts at a time for transfer, loading and unloading.

Next major step is the drilling of eight oil holes from main bearings to pins; and drilling of four lightening holes in the pin bearings. This is done in a large, 36-station Kreuger-Barnes transfer machine. It may be noted that the reason for having so many operating stations is that holes are drilled only part way through at any given station, requiring four or five stations for completing each hole.

Next comes the drilling, counterboring, recenter ream, tapping and spotfacing to length both ends of the shaft. This is done in a 14-station Snyder double-end transfer machine. It may be added that this machine, too, is fully automated with respect to loading and unloadas well as automatic transfer to the next operation.

Crankshafts now are ready for grinding. Here the processing is also confined to just two operations —one of the main bearing line; the other for the pins—these being handled in four different grinders.

First grinding stage is on the finish-grinding of the five main bearings and oil seal diameters. This is done in Landis 16 x 40 HIW, five-wheel grinders. Operation of all grinders is fully automated not only as to loading and unloading, but automatic loading and unloading to the Sheffield Column gaging station, and transfer to the next operation. Tolerance on ground diameters is held to a range of 0.0006 to 0.0008 in., taper and out-of-round being held to 0.0002 in. Surface finish is held to a maximum of 30 microinches.

The gaging station automatically gages all five main bearings at two points. If a shaft is rejected, the grinder is automatically stopped and will stay stopped until the machine setter makes the necessary adjustments.

From the gaging station the work is transferred automatically to the Landis pin grinders for finish-grinding diameter and width of pins. There are four grinders in the line and each one takes just one pin.

Following grinding, the shafts are transferred to a large Centri-Spray indexing type washing machine, then transferred to next operation. Here they have a Sundstrand Type A automatic stub lathe for handling the following operations: finish-turn No. 3 main bearing thrust walls; face both sides of oil slingers; face outside flange face and hub OD. Here, too, there is automatic loading and unloading, as well as transfer to next operations.

The post diameter and gear face now are turned in a Sundstrand special automatic lathe. The gear face is held square with front and rear main bearings within 0.001 in TIR. This is followed by the milling of two keyways in the post and milling of the balance drive notch in the flange, in a special Sundstrand milling machine. Keyways are held to 45 deg of the centerline of the Nos. 1 and 4 pin bearings.

Following balancing, mentioned earlier, bearing diameters, as well as the No. 3 main bearing thrust faces, are polished in an Impco four-station, micro-finishing machine. Surface finish of diameters is held to 12 microinches. At this operation, oil seal diameter is serrated to prevent rear seal oil leaks.

All oil holes then are brushed and flushed clean in an eight-station Impco machine. And finally, the crankshaft is presented to the 32-column Sheffield gaging machine for final inspection. This is one of the few instances where the work is removed from automation and handled manually.

Piston Pin Extrusion

Piston pins are produced by cold extrusion in a new process cycle at Lima. They start in the form of 15-ft-long bars of SAE 5015 fine grain cold heading quality, cold drawn steel bars, annealed to a Brinell hardness of 140 max. The bars are cut to length in a one-inch, four-spindle vertical-type Conomatic chucking machine. This produces slugs 2.374 in. long with chamfer. Weight of the slug is the most important characteristic, since it must result in a finished pin of the right size. Rough weight is held between 228.5 and 229.5 grams.

Slugs are washed and transported to the F. B. Stevens fully-automatic barrel-plating machine, where they are coated with zinc-phosphate and a soap lubricant. The plating cycle consists of the following operations:

Alkali clean	Cold rinse
Hot rinse	Alkali rinse
Acid pickle (sulfuric acid)	Drawing lubricant
Cold water rinse	Hot air dry
Hot rinse	Alkali rinse
Phosphate coating (three stations)	Hot rinse

Extrusion is done in a 500-ton Danly dual slide extrusion press, extruding from both ends with special carbide punches, leaving a short solid section in the center. The pin is struck again for sizing to length by means of flat punches, to a length of 3.5 in. Extrusion is done at extremely high speed, producing upward of 1900 pieces an hour.

Both ends now are chamfered in an Economy Type 5200, double-end chamfering machine, fitted with a Feedall attachment. The web or solid portion left in the pin then is drilled through in a 10-station Krueger-Barnes horizontal, duplex continuous machine. This hole is reamed in another 10-station Krueger-Barnes machine.

The pins are washed and transported to heat treat. Here they are gas carburized at 1700 F in special Holcroft carburizing furnaces, caustic quenched at 1600 to 1630 F. Then they are strain drawn for one hour at 375 F.

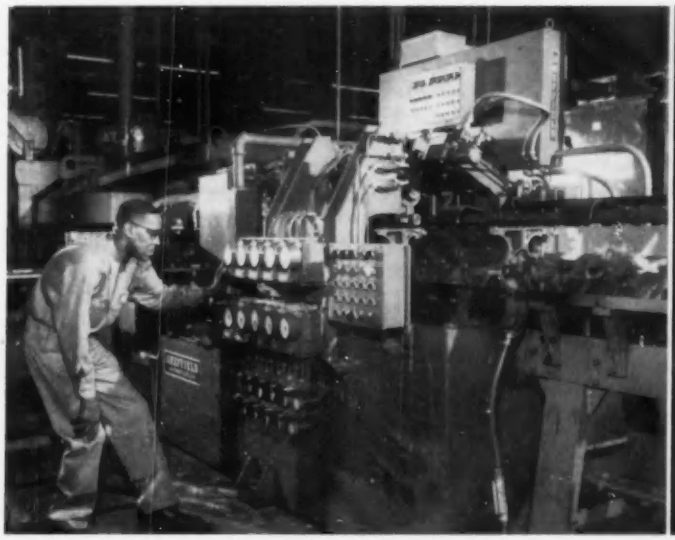
Pins are ground on the OD in Cincinnati centerless grinders with throughfeed, employing a Feed-O-Matic hopper and automatic sizing and gaging. Grinding is done in five passes—roughing in a No. 3 machine; three semi-finish-grinding passes in No. 2 machines; and finish-grind in a No. 2 Cincinnati centerless—and a lapping finish in a No. 2 Cincinnati centerless lapper. This gives a total of six passes, resulting in a final tolerance of 0.0003 in. total, later graded into a range of three sizes in a Sheffield gaging and sorting unit. Finished weight runs from 205 to 207 grams, about 21 grams less than the rough weight of the initial slug.

Pins are washed and dried, being held at a controlled temperature of 70 to 75 F for gaging and sorting.

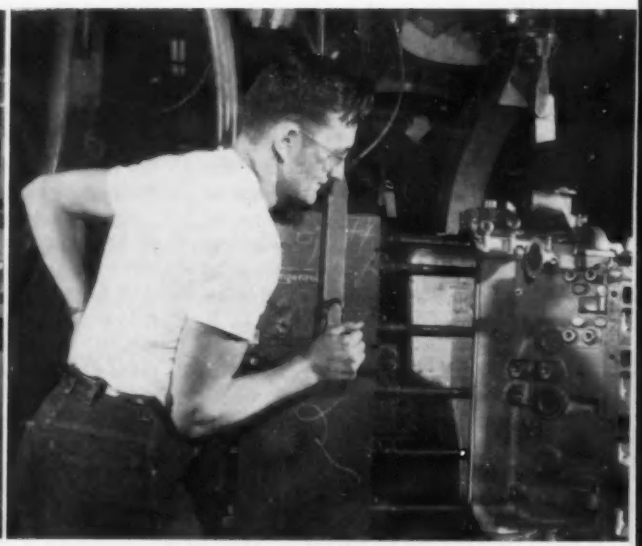
This Article Is Second Installment on Ford's New Lima Engine Plant, First of Which Appeared in AUTOMOTIVE INDUSTRIES *for October 1, Page 50.*

BLOCKS AND ENGINES

One of the highlights of the new engine plant is the extensive use of quality control gages to check parts during machining. This Sheffield gage automatically checks various diameters in the cylinder block and rejects blocks that fail to meet engineering specifications.



Among the multi-spindle tools used on engine assembly line is the 14-spindle Ingersoll-Rand nut runner here shown.



Engine and Brake Developments Among Topics at

SAE Transportation and Diesel Engine Meetings

By Charles A. Weinert

MULTIFUEL engines, liquid-cooled brakes, and a molded fiber-glass-reinforced plastic truck cab were some of the subjects of major current interest discussed at the National Transportation and Diesel Engine Meetings of the Society of Automotive Engineers.

The excellent five-day technical program also viewed utility-gasoline-engine combustion chamber deposits, light-service Diesel and LP-gas applications, free-piston-engine supercharging, and design of truck cooling systems. Several aspects of Diesel engine design—thermal loading, aftercooling in turbocharged engines, and cold starting—likewise received considerable attention.

A group visitation to the U. S. Army Ordnance Proving Ground at Aberdeen, Md., on Tuesday, October 21, proved to be another outstanding feature. Here the emphasis was on techniques used in testing ordnance vehicles.

The military concept was expanded in a fine talk given by Major General Frank S. Besson, Jr., Chief of Transportation, U. S. Army, the featured speaker at the following day's luncheon meeting. Subject of his address—in which he cited illustrative recent vehicle developments—was "Mobility for the Army in the Atomic Era."

Held in Baltimore, Md. on October 20-24, the conference was co-sponsored by SAE's Diesel Engine, Transportation and Maintenance, and Truck and Bus activity committees. Attendance was on the order of 500, and included truck fleet operators, as well as executives and engineers from the automotive engine and component makers.

Highlights of the various sessions are presented in the following:

Truck Service Brakes

New brake designs were described in the opening technical session. These comprise a floating two-shoe type of 15-in. diam, developed by Rockwell - Standard Corp.; and a liquid-cooled disk type brake for wheel mounting, as well as a liquid-cooled drum type brake for propeller shaft mounting, developed by Wagner Electric Corp.

Design and operational features of the Stopmaster brake (Fig. 1) were given by F. T. Cox, Jr., Rockwell-Standard Corp. Capable of actuation either by air or hydraulic means, the shoes are spread by a right-angle wedge device fitted with anti-friction rollers. This was done primarily to permit brake assembly into a more limited space. Abutment load has been removed from the actuation device, the brake being designed with an integral spider which takes the abutment load—and at the same time houses the actuating device.

In the hydraulic version, the cylinders have been moved outside the brake, reducing heat transfer to the hydraulic fluid. In the air version, actuation means have been brought in closer to the brake mounting.

Results of tests displayed by the speaker showed substantial increases in brake stopping performance, in resistance to fading, and wear life—attributed to better distribution of work in the brake and improved cooling of drums.

The two configurations of liquid-cooled brakes were described by J. D. Dudley, Wagner Electric Corp. Both are piped to the engine cooling system for dissipation of braking heat energy.

The speaker cited results of road tests which showed the brakes could be snubbed repeatedly without temperature build-up and that lining wear was extremely low. He said it was conceivable their service life would extend to that of normal engine overhaul periods. Design details of both the wheel type and propeller shaft type brakes will be published in a subsequent issue of AI.

Combustion Deposits In Utility Engines

Power losses and relatively short service life, due to rapid forming

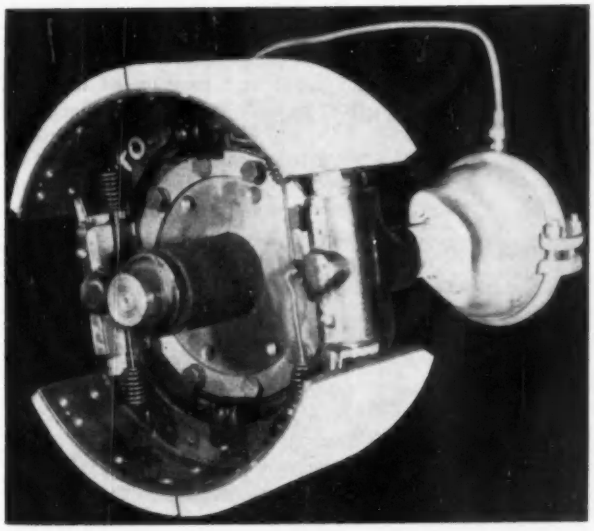


Fig. 1—The arrangement of Rockwell-Standard brake with right - angle actuation

of combustion chamber deposits, are critical in the constant-speed constant - load service to which many utility engines are subjected. This situation was made apparent during the second session of the conference, where a paper co-authored by H. T. Mueller and E. C. Paige, Ethyl Corp., and a paper by Walter Klausler, Thermo King Corp., were presented.

The resinous deposit from partially-burned lubricating oil is considered to be the binder which catches and holds fuel deposits and other materials. Therefore, use of newer type oils which form less resinous material may offer some relief.

Engine design has some bearing —overhead valve engines being less affected than L-head engines. Minor design changes, such as increased valve opening have given major improvements in specific instances.

The selection of engines of adequate power was said to offer a possible important contribution. Rigidly-followed routine maintenance is another user factor considered essential to minimize the deposit effect on engine operation.

Aberdeen

Visitors to Aberdeen Proving Ground were shown test facilities for "frame-twisting" vehicles and for evaluating full-load performance characteristics, performance on grades up to 60 per cent, and severity of vibration imparted to vehicles and occupants during controlled rough-terrain operation. In addition, results of tests on a Deutz multifuel engine were given, followed by sequentially running the engine on Diesel fuel, JP-4, and gasoline.

Demonstrations were made of some 25 different Ordnance vehicles, ranging in size from the small ½-ton 4x4 "Mechanical Mule" carrier to 60-ton tank transporters. Recently-developed vehicles on review were a ¾-ton 6x6 low-silhouette cross-country carrier, an experimental 5-ton 8x8 cross-country carrier, and the "Rolligon" pneumatic roller carrier. Also demonstrated was a new amphibious armored infantry carrier, which was put through its paces in the nearby swim basin—as were a number of the other vehicles.

Theme of the ordnance show was "more firepower with less weight," as evidenced by the newer type vehicles displayed. It was also indicated as being the major goal of future ordnance vehicle development.

Light-Service Diesel

The Perkins Four 99 Diesel engine, recently put into production after several years of field testing, was the subject of a presentation by J. S. Bright, F. Perkins (Canada) Ltd.

This engine is a four-cylinder-in-line four-stroke type, having a bore of 3 in. and a stroke of 3.5 in., for a total piston displacement of 99 cu in. Maximum rated bhp is 43 at 4000 rpm, and maximum torque is 73 lb-ft at 2200 rpm.

The engine was developed for use in commercial vehicles below 5000 lb GVW and in medium-size European automobiles and taxicabs. Its design details were described in AUTOMOTIVE INDUSTRIES for May 15, page 59.

In his talk the speaker gave increased mileage factors (IMF) which had been obtained with the engine in a variety of test applications. IMF is the fuel mileage of the Diesel as related to that obtained in the same vehicle with a gasoline engine. These factors

TABLE I

LP-GAS CARBURETOR SALES BY USE

1956-1957

Use	1956 Units	1956 Per Cent	1957 Units	1957 Per Cent
Farm Tractors*	55,087	49.8	48,782	46.4
Industrial Trucks	21,545	19.5	22,226	21.1
Motor Trucks	13,105	11.8	11,058	10.5
Automobiles	10,051	9.1	13,278	12.6
Stationary Engines	7,440	6.7	7,115	6.8
Buses	389	0.4	225	0.2
Miscellaneous**	2,999	2.7	2,500	2.4
Totals	100,616	100.0	105,184	100.0

* Conversion carburetor sales only—other categories include conversion and original equipment sales.

** Includes truck refrigerators, sweepers, loaders, etc.

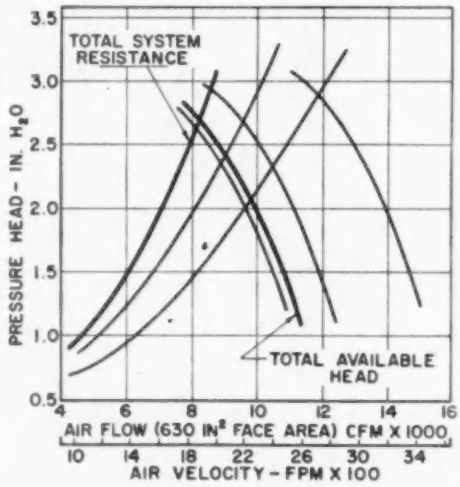


Fig. 2—Airflow system-chart

ranged from 1.7/1.8 in long and medium distance hauling, to as much as 2.0/2.1 in door-to-door stop-start delivery service.

LP-Gas Applications

Savings in operating cost through use of L-P gas as a motor fuel were reported by C. F. Loftin, Power Motor Fuel Sales Co., Div. Warren Petroleum Co. Several taxicab companies claim they save an average of ½¢ per mile.. Fork lift truck operators report savings from $200 to $500 per year in maintenance costs. And refrigerated truck lines claim similar savings.

As indicative of the extent and variety of applications in which L-P gas is being applied, the speaker exhibited the accompanying tabulation (Table I), which lists sales by use during 1956 and 1957. Farm tractors lead the list—it being separately estimated that more than 400,000 LP-gas tractors are in use today, representing 8 to 10 per cent of all farm tractors. Industrial trucks are next—with an estimated total of 73,000 currently in use.

Truck Cooling Systems

Present-day demands are placing heavy burdens on the cooling system designer, according to three experts who spoke at a symposium devoted to truck cooling systems.

Beyond the primary function of maintaining engine temperatures at levels conducive to long life, the cooling system has been called upon to handle added duties in the form of automatic transmissions, other oil coolers, and air compressors, F. W. Person, International Harvester Co., explained. And now studies are being conducted on retarders and watercooled brakes which use the cooling system for dissipating the heat generated during braking.

Meanwhile, the problems have been magnified, he stated, by increasing engine outputs, air conditioning condensers, and poorly-designed grilles.

The second speaker, L. A. Zwicker, Harrison Radiator Div., General Motors Corp., reiterated most of the previously-mentioned problem items while going more into the coolant heat transfer aspects of heat exchangers. Styling trends likewise have had an adverse effect, he added —resulting in less available space for the radiator, shroud and fan, and presenting more difficult design conditions for air entrance and exit.

Mr. Zwicker placed some emphasis on aeration and water loss (due to expansion) as sources of definite reduction in cooling system capacity. He advocated, in this connection, top tank capacity of at least 15 per cent of the system; full-length top tank baffling for best water flow distribution to the radiator core; and location of filler in the top tank remote from the inlet to the top tank. Also inlet and outlet fittings and hoses of a size to give minimum water pressure drop across the radiator; design of pump impeller for minimum internal creation of cavitation; and thermostat valve area of adequate size for minimum pressure drop across the thermostat.

Airflow through truck cooling systems came in for specific attention in a paper presented by E. R. Klinge, Ford Motor Co. It was made evident in his talk that calculated and actual cooling system performance do not always jibe—which the speaker attributed mostly to a lack of understanding of "installed airflow."

He suggested methods for dealing with the variables, including the use of "system charts" in which the individual effects may be superimposed upon each other for combined analysis and conclusion. Such a typical chart is illustrated in Fig. 2.

Multifuel Engines

The symposium on multifuel engines, where seven papers were presented, attracted the largest attendance of all the sessions—indicative of the great interest in this development at the present time. Overall aspects observed at the meeting are:

The development has stemmed primarily from the desire of Ordnance to have engines adaptable for whatever fuels may be available in the field—Diesel fuel, JP-4, and gasoline. There was a hint that it will also fit into some commercial applications advantageously.

Compression-ignition type engines are indicated. The biggest problem has not been in burning Diesel fuel and JP-4, but in burning gasoline. In general, compression ratios have had to be increased for that purpose; and power outputs are, if anything, less with gasoline. The higher the octane, the worse the results. Cold starting has also been a problem with gasoline; as has also, to some extent, lubrication of fuel pumps and injectors. (*Turn to page* 136, *please*)

Studebaker-Packard's New Line of Trucks

Scotsman V-8 half-ton truck

LEADER in the Studebaker-Packard line of trucks for 1959 is the Scotsman pickup which accounted for 25 per cent of its sales last year. It is offered either with the new short-stroke 170-cu in. L-head Six or with the 259-cu in. V-8 which develops 180 hp at 4500 rpm. It has a rating of 5000 lb GVW.

In addition, the company offers its full line of Transtar trucks which range from a half-ton to two-ton vehicles, as well as powerful 4 x 4 drive units. GVW ratings range from 5000 to 19,000 lb.

For the complete line, S-P offers three different powerplants—the L-head Six, the 259-cu in. V-8, and the 289-cu in. V-8.

A heavy-duty, three-speed transmission is standard with both the new Six and the V-8. A four-speed synchromesh transmission and overdrive are optional with both engines. Automatic transmissions are optional with the V-8.

Single-stage rear springs are standard. Heavy-duty, two-stage rear springs are optional. Other options include Twin Traction, which transmits power to the rear wheel with the greater traction.

The Transtar half-tone deluxe is offered in a 112 or 122-in. wheelbase. Both have a gross vehicle weight of 5200 lb.

The 112-in. wheelbase type has a 6½-ft pickup body while the 122-in. is available in either an eight-foot pickup or stake body.

The 289-cu in. V-8 develops 225 hp at 4500 rpm with a four-barrel carburetor. A three-speed transmission is standard. A four-speed synchromesh transmission, overdrive and automatic transmission are optional.

Two-stage springs are standard equipment. Heavy-duty, two-stage springs are optional. Among other options are: a heavy-duty engine, four-barrel carburetor, heavy-duty battery and radiator, booster brakes and Twin Traction.

The Transtar three-quarter-ton DeLuxe has a 122-in. wheelbase and a gross vehicle weight of 7000 lb. An eight-foot pickup, platform or stake body is available.

The 289-cu in. Power Star V-8 is the same as on the Transtar half-ton DeLuxe. Standard and optional transmissions are also the same.

The Transtar two-ton, heavy-duty trucks have a gross vehicle weight of 19,000 lb. Wheelbases are 131, 155, 171, 195 and 212 in. Platform or stake bodies are nine feet long in the 131-in., 12 ft in the 155 and 14 ft in the 171. Stake bodies are 88¼ in. wide and platform bodies 93⅝ in. The 131-in. wheelbase is used primarily for tractor operation or dump truck use, it was stated.

The Torque Star heavy-duty, 289-cu in. V-8 engine develops a maximum horsepower of 225 at 4500 rpm with a four-barrel carburetor. It has premium features built in for longer life and lower operating cost under severe conditions.

A four-speed, heavy-duty transmission is standard. Offered as options are five-speed direct and overdrive transmissions.

Transtar four-wheel drive trucks come in half-ton, three-quarter-ton and one-ton sizes. Gross vehicle weights range from 5400 to 10,000 lb. Wheelbase is from 112 to 131 in.

The power plant is a Power Star 289-cu in. V-8 engine that develops a maximum of 210 hp at 4500 rpm and a maximum gross torque of 300 at 2800 rpm. The bore and stroke are 3 9/16 x 3⅝ in., and the compression ratio is 7.5-1. ■

Thomas, DeYoung Elected To Top Posts at Goodyear

E. J. Thomas has been elected chairman of the board at Goodyear Tire & Rubber Co. and Russell DeYoung has been named president to succeed Thomas.

Thomas, who continues as the chief executive officer, succeeds P. W. Litchfield, now the honorary board chairman. DeYoung, formerly executive vice-president of Goodyear, becomes the company's ninth president.

In other top changes, P. E. H. Leroy, executive vice-president, becomes vice-chairman and continues as chief financial officer; Sam DuPree moves from vice-president and coordinator of general managers to vice-president of production; Richard A. Jay, assistant to the president, replaces DuPree.

Latest Developments in Missiles, Rockets and Aircraft Disclosed at SAE Aeronautic Meeting

By R. Raymond Kay

LOS ANGELES, CALIF.

JUST over a year ago the Soviet Union launched its Sputnik—the spark that set the fire. Today, the U. S. is shooting for the moon.

There are new challenges constantly. The aircraft-missile industry's role in defense procurement is changing. We're now getting "a new flexibility in most companies. Their resources can be applied in whatever area and manner may be most beneficial to the nation." That's the word from J. L. Atwood, president of North American Aviation, Inc.

Mr. Atwood contrasts this concept with the earlier one when companies were pegged by their product: airframe; engine; or instruments.

"A firm now," he explains, "may be a prime contractor on one program and a subcontractor on another. It may undertake a complete weapon system today and a small component of a subsystem tomorrow. The net effect of all this is to increase the competitive factor and bring a maximum of fresh thinking to each problem."

Mr. Atwood points to recent competitions where 20 or 30 companies tried to convince a Government agency or prime contractor that each was best qualified to do the job. He suggests that this is the only way for the nation to fully utilize all its resources.

Space age technology is the No. 1 problem facing the aircraft-missile industry today. New materials, new tools, new techniques and methods must be developed to keep pace with demands of development and production.

Is Industry Equal to Challenge?

Big question: Is the industry equal to this challenge? It must be if this nation is to survive the race for the conquest of space.

Year after year in Los Angeles, the Society of Automotive Engineers' National Aeronautic Meeting offers an excellent forum to hash over "what's new" in missiles, rockets, aircraft, and nuclear propulsion power plants.

This year's meeting, held Sept. 29-Oct. 3, was right up to par. And SAE offered a full menu, including an exhibition of the latest equipment for aircraft and missile making.

One thing is certain. Quality, not quantity is the order of the day. Pentagon planners still put emphasis on precision production of limited quantities of more and more complex materiel.

Higher-Strength Materials

The next generation of missiles of high Mach number will need higher strength-density ratio material for the separable propulsive systems. And that goes for liquid or solid fuel. High strength aluminum alloys fulfill some needs. Steels now on the market are not of high enough strength. That's what Leo Schapiro, Chief Metallurgist at Douglas Aircraft's Santa Monica Div., believes.

Incidentally, in the general clamor for exotic metals for air vehicles that need them let's not forget the vehicles that don't need them. The next generation of Mach 0.85 jetliners will spawn a generation of Mach 1.04 jetliners. None of these will need exotic materials for their airframes, Dr. Schapiro says.

Look for even greater use of sandwich construction in tomorrow's air vehicles. The trend at the moment is toward brazed honeycomb because of its multidirectional strength characteristics.

Today's B-58 bomber has 1000 sq ft of sandwich construction. But the B-70 will have 18,000 sq ft. In fact, the entire wing and control surfaces of this chemically-fueled bomber will probably be both brazed honeycomb and welded corrugated sandwich.

New Manufacturing Philosophy

Industry is in for a numerically controlled future. That's a fact. But to have it soon and have it good needs solid, long range plan-

ning starting today. That goes for both men and machine tools.

M. C. Copold of Convair says you've got to take a fresh look at your production make-up.

Numerically controlled machine tools will cut your costs. Ratio of production costs to sales will be decidedly in your favor.

He urges management to study, accept, and plan for this important new manufacturing philosophy.

Gov't-Industry Coordination

About 78 pct of a modern bomber squadron's ground support equipment (GSE) is non-standard. So said Major General A. G. Hewitt, Director of Maintenance Engineering, Air Force Engineering Headquarters, Washington, D. C. When a new bomber goes into production. much GSE becomes obsolete. So the Air Force budget has skyrocketed.

Converting an F-84F squadron to F-100's takes about 220 new GSE items. And some 300 new items are needed to convert a squardron to F-104's. Too often this equipment is not standardized. Today we have about 27 different jet starting units, among them, the MA-1, MA-1A, MA-2, MA-3. Each is bigger and more complex. Better Government/industry coordination could cut unnecessary costs.

General Hewitt cited the MJ-3 hydraulic mule and a bomb navigation evaluator as complicated items of major cost. But electronic test equipment still holds the lead as the largest GSE dollar expenditure.

About 12,000 new supply items enter the Air Force inventory per month. Each must be analyzed for possible early obsolescence.

A weapon system's design stage is the best time to standardize. It's still hoped to standardize support and test equipment for the B-70, F-108, and many of the missiles now in research and development.

Most contractors haven't had enough information to help them integrate standard gear into weapon systems and support equipment. A GSE technical information file is now being worked up by the Air Materiel Command and industry. Target date of this project is January, 1959.

Brazed Honeycomb Sandwich

Suggestions on how to incorporate brazed honeycomb sandwich material into design were part of a paper by Floyd F. Rechlin, project engineer, Solar Aircraft Co. He gave six basic keys:

1. Minimize detail design subject to the extremely tight tolerance requirements of the brazing process.
2. Make allowances in design for uniform brazing pressure and temperature distribution.
3. Consider brazing temperatures and pressures in the choice of structural material.
4. Insure that the design can be assembled for brazing.
5. Incorporate varying core densities to transmit loads internally.
6. Attempt to treat honeycomb sandwich as a material.

To the designer, Mr. Rechlin said, there is a challenge in establishing new stress parameters and design criteria. These must take utmost advantage of the high strength-to-weight ratios, multidirectional properties, and inherent rigidity of honeycomb sandwich.

The fabricator's challenge centers on a need for a complete understanding of the manufacturing and brazing processes, and for large-scale research and development programs on the use of high temperature materials and brazing alloys.

In his paper, "Practical Design Suggestions for Users of Brazed Honeycomb Sandwich," Mr. Rechlin said that it will soon be possible to:

(a) Take flat honeycomb sandwich panels "off the shelf."
(b) Rough cut them to size.
(c) Form them to the desired shape or curvature.

(*Turn to page* 100, *please*)

COMPANIES WHICH DISPLAYED EQUIPMENT

Lear, Inc.
Universal-Cyclops Steel Corp.
Air Logistics Corp.
Fairchild Engine Div., Fairchild Engine & Airplane Corp.
Westinghouse Electric Corp.
Lord Manufacturing Co.
Breeze Corporations, Inc.
Rubber Teck, Inc.
Strator Div., Fairchild Engine & Airplane Corp.
Solar Aircraft Co.
Jones & Laughlin Steel Corp.
McCormick-Selph Associates
C. G. Hokanson Co., Inc.
Formsprag Co.
Hoover Electric Co.
Foote Bros. Gear & Machine Corp.
Pacific Scientific Co.
Cleveland Graphite Bronze Co. Div., Clevite Corp.
Garrett Corp.
Rohr Aircraft Corp.
Permanent Filter Corp.
Northrop Aircraft, Inc.
Pesco Products Div., Borg-Warner Corp.
Continental Aviation & Engineering Corp.
Southwest Products Co.
Gits Bros. Manufacturing Co.
Clemco Aero Products, Inc.
Lycoming Div., Avco Manufacturing Corp.
Rosan, Inc.
Automatic Switch Co.
Weatherhead Co.
Swedlow Plastics Co.
Ryan Aeronautical Co.
Wyman-Gordon Co.
Western Gear Corp.
Rocketdyne Div., North American Aviation, Inc.
Indiana Gear Works, Inc.
Missile Development Div., North American Aviation, Inc.
Armco Steel Corp.
Kelsey-Hayes Co.
Hi-Shear Rivet Tool Co.
Stratoflex, Inc.
Bower Roller Bearing Div., Federal-Mogul-Bower Bearings, Inc.
Microtech Corp. Div., Federal-Mogul-Bower Bearings, Inc.
Arrowhead Products Div., Federal-Mogul-Bower Bearings, Inc.
Stewart & Stevenson Services, Inc.
Martin Co.
Weston Hydraulics, Ltd.
Lisle Corp.
Sundstrand Turbo Div., Sundstrand Machine Tool Co.
Sundstrand Aviation Div., Sundstran Machine Tool Co.
Monadnock Mills
Stephens-Adamson Manufacturing Co.
Consolidated Controls Corp.
Aluminum Co. of America
Commercial Engine Operation, General Electric Co.
Aircraft Accessory Turbine Dept., General Electric Co.
Aircraft Nuclear Propulsion Dept., General Electric Co.
Firth Sterling, Inc.
Cooper Precision Products
Nutt-Shel Co.
Pacific Alloy Engineering Corp.
Dean & Benson Research, Inc.
Eckel Valve Co.

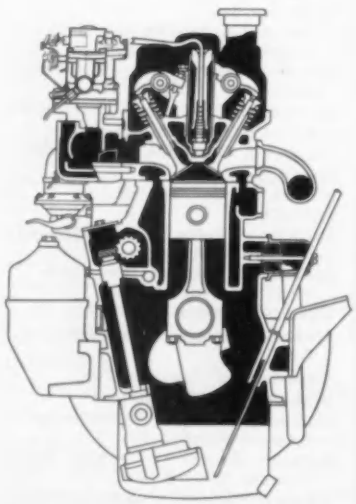
Aston Martin DB 4 with new 263-hp engine

New Cars at Paris Exhibition Show Trend to Italian Styling

By Robert Braunschweig

PARIS, FRANCE

THE 1958 Paris Automobile show found the French automobile industry achieving new production records. During the first half of 1958 passenger-car output totalled 487,117 units. This was 31 per cent higher than the figure for 1957. Exports had gone up to 130,288 units; 59 per cent higher than for 1957. This was due partly to the rapid increase of sales in the United States. Renault is building 1400 Dauphine models daily, and new installations at the Poissy plant of the Simca group have made the production of special models possible.



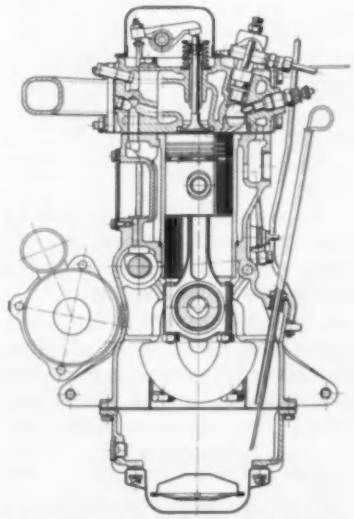
Transverse sectional view of the new Humber Super Snipe engine

At the Paris show the industry's trends are reflected in several ways. One is discarding national body styling in favor of a new European style, created chiefly by the leading Italian designers. Another is the exchange of components between firms from different countries. British brake units are used in France and Italy, French tires are fitted on Italian and German cars, and German synchronizing units are used in Italy and England.

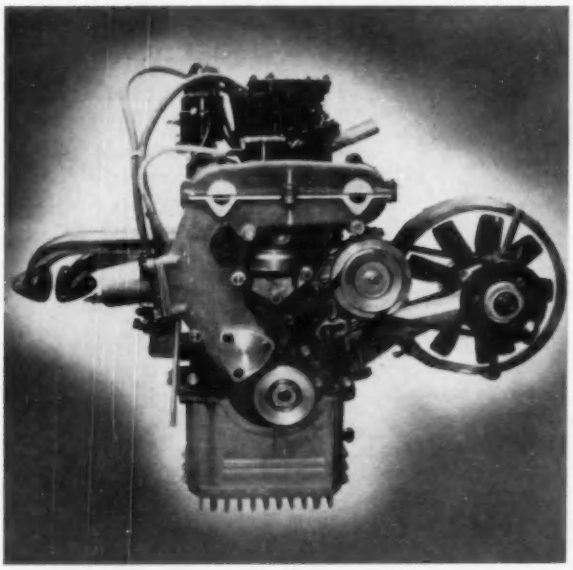
French passenger car design for 1959 is influenced by the high cost of fuel and the vehicle tax of approximately $250 for engines of about 150 cu in. displacement. This high tax has caused the disappearance of the once well-known French luxury cars with the exception of the Chrysler-engined Facel Vega. Expensive fuel has led the French firms to emphasize economy features.

Renault displayed a small Diesel engine suitable for light road vehicles. Its fuel costs about 50 per cent less than gasoline. Renault also featured the Floride, a special version of the Renault Dauphine. This is an Italian-styled two or four passenger car which will be available as a soft top convertible with a detachable hard top, or as a coupe.

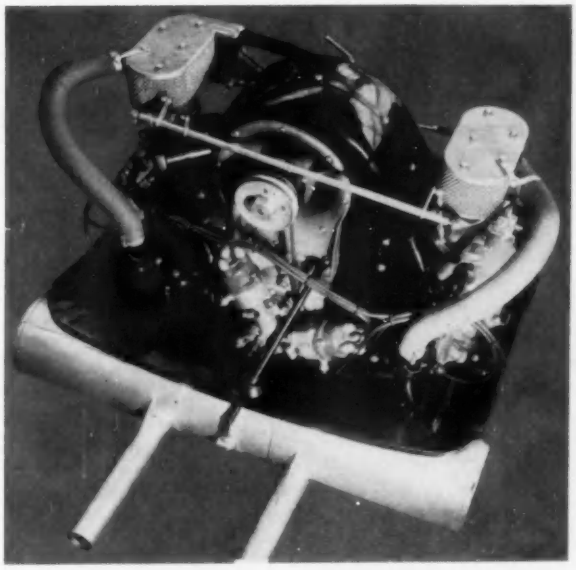
Peugeot's small Indenor 85 TMD 4 Diesel engine is the only compression ignition engine of its size made in France. It is slightly larger than the standard Peugeot 90 cu in. gasoline engine that has the



Peugeot Indeenor Diesel engine



Abarth-Fiat 750 cc engine with twin ohc valve gear



Porsche Carrara 96.5 cu-in. four cylinder ohc engine which develops 105 hp

same overall dimensions. At the present time it is available only for taxicabs, delivery trucks, and some station wagons. This OHV four-cylinder unit develops 48 gross horsepower at a governed speed of 4000 rpm. It weighs approximately 100 lbs more than the gasoline power unit it replaces.

Several British makers displayed new models at the show. The Rootes group introduced a new Humber Super Snipe which uses the body and chassis components of the four cylinder Hawk model. It is powered by a six cylinder engine with a bore 3.45 in., stroke of 3.45 in. and a displacement of 161.8 cu in. It develops 105 net hp at 5000 rpm. A Borg Warner automatic transmission can be supplied as optional equipment.

Aston Martin introduced a new four passenger sports car powered by six-cylinder engine which develops 263 gross hp at 5500 rpm. It has a bore of 3.62 in. and a stroke of 3.62 in. and a piston displacement of 223 cu in.

The Austin A40 with a novel body design by Pinin Farina also was on display. Its chassis components are similar to those of the smaller A35 Austin.

A new Porsche convertible coupe was introduced at the show. This car replaces the former speedster model Porsche.

A new Fiat-Abarth 750 model sports coupe was among the Italian cars at the show. Its engine develops 67 hp at 7000 rpm. A Cadillac with a special body by Pinin Parina was probably the largest vehicle displayed. ■

Chrysler Sales Veep Predicts 8 Million Car Year Ahead

Sales of 5.5 million passenger cars in the coming year will be just a prelude to the big years ahead, says Byron J. Nichols, Chrysler Corp. vice-president—automotive sales.

Factors such as population growth will build 8 million car years in the mid-sixties, according to Nichols. A gain of 3.5 million persons a year will add 20 million to the nation's population by 1965 and another 35 million by 1975.

About 80 per cent of this growth, he adds, will be in the suburban areas where private transport is a must.

Nichols says Chrysler is building its dealer organization so that each dealer will have greater immediate sales opportunities and room to grow in the Sixties.

GM Laboratories Open New Florida Test Field

GM's Research Laboratories have opened a new 10-acre test field in South Dade County, Fla., to test both interior and exterior items which are subject to weathering.

The new test field, operated by Research Laboratories chemistry department, handles an average of 2000 samples a month from most of GM's operating divisions and subsidiaries in this country and abroad. The field replaces a 30-year-old site near Miami which started as a paint exposure field but expanded to cover many other test items.

AMP Forms Engineering Div., Hires University Scientists

American Metals Products Co., Detroit automobile parts manufacturer, formed a new Engineering Science Div. Two scientists from the University of Michigan will constitute the nucleus of the staff.

AMP president Andrew M. Mras said the new division will concentrate on development and production of new materials "to accelerate progress in nuclear power, outer space vehicles and missiles."

Dr. Harold A. Ohlgren and Dr. John G. Lewis, both from Michigan's Engineering Research Institute, have joined the division, which is headed by Fred C. Mattaei, Jr.

Demand *for* Economy *affects* Engine Trends

By

Joseph Geschelin

A SEVERE recession in car buying together with other factors combined to change the engine picture materially for the 1959 model year. Most noticeable is the fact that although many engines were increased in displacement, no one attempted to reach for still higher horsepower. In fact, the Chrysler 300E engine is the only one at the very top rating and it is held to 380-bhp.

More Sixes

Bowing to an unquestioned demand for better economy in lower priced cars, the industry has revived the six-cylinder engine. Only a few lush years ago the Six appeared to be out of the picture in passenger cars and it was assumed that production would be maintained primarily to take care of commercial vehicles and fleet operations. Look at the picture today. Sixes are offered by Ford, Chevrolet, Plymouth, AMC, Studebaker-Packard, and Dodge. What is more significant, however, is that Sixes are being made available on Edsel cars as well.

Price resistance, economy, and perhaps a stemming of the tide of the battle of the horsepowers has wrought some other important changes. Significantly, only a few manufacturers are offering the special three, two-barrel carburetor package. Last year many were in the act. Moreover, Chrysler 300E, DeSoto Adventurer and Dodge Super D-500 appear to be the only ones offering the two, four-barrel carburetor package.

Fewer Four-Barrel Carburetors

Coincidentally, there are more V-8's with two-barrel carburetors. And some of the manufacturers offer a strictly economy engine with a two-barrel carburetor, calibrated for economy of operation, coupled with much lower compression ratio.

Buick now has two different engines, and so has Oldsmobile. In both instances, the aim is to provide better fuel economy in the lower priced lines. Chevrolet has its Six and two V-8's. However, they offer four different induction options for each of the V-8's thus providing a large family to choose from. Pontiac has just one engine but it is offered with a two-barrel; a four-barrel; and two, three-barrel carburetor versions to provide a wide range of outputs.

Fuel Injection

What has become of fuel injection? A lot can be said pro and con. The fact remains that Chevrolet is the only one to stay with it this year. It is offered in two versions, one of these being in combination with a special racing camshaft, strictly for road racing fans. Unquestionably price resistance had as much to do with the change as any other reason.

Optimum Engine Characteristics

As in the past, this study is confined to V-8 engines and only to those models that are available with a four-barrel carburetor. The chief reason for this choice on our part is to present the optimum characteristics of any given engine. With the reduction in options for 1959 the current tabulation covers only 29 engines.

There is another interesting observation that can be made. Despite the increase in displacement of many engines, the present dictates of economy have restricted the development of maximum bhp/cu in. Examination of the values in the tabulation will show that the ratio of bhp/cu in. has declined moderately by comparison with previous years. In fact, the only high value is for the 283-cu in. Chevrolet engine, with fuel injection and racing camshaft. Its ratio of 1.024 stands quite alone. The nearest high value is for the 389-cu in. Pontiac V-8 with two three-barrel carburetors and this is 0.964.

Top Tabulated Engines

If we rate the top tabulated engines according to the ratio of bhp/cu in., they run as follows, in descending order: Chevrolet, Chrysler 300E, DeSoto Adventurer, Chevrolet (3 two-barrel carburetors), Dodge Super D-500, and Pontiac.

We mentioned maximum horsepower output earlier. In this category, the Chrysler 300E is at the top with 380 hp. The next range is 350-hp and in this category we have—Chrysler Imperial and New Yorker, DeSoto Adventurer, Lincoln and Continental, and the optional Thunderbird engine.

Just below this is the 345-hp range, including—Pontiac (3 two-barrel carburetor), Cadillac Eldorado, Dodge Super D-500, and Mercury. Stock DeSoto, Chrysler Saratoga, and Buick come next with 325-hp, while the stock Pontiac is rated 330-hp.

Compression Ratios

Up to last year engine designers were pushing compression ratio as high as possible consistent with commercial octane ratings of pre-

mium fuels. Last year, according to informed people, maximum octane ratings at the pump varied so much over the USA that car owners of many makes found it difficult to satisfy engine requirements. As a result, compression ratios this year were marked down moderately not only on engines in the Ford family but in all Chrysler divisions, and by Oldsmobile. The tabulation shows that the Chrysler family, Thunderbird, Mercury, and Lincoln all are at a compression ratio of 10 to 1. Ford and Edsel are at 9.6 to 1.

Nevertheless, compression ratio of some makes has been upped. This is true of Cadillac, Pontiac, Buick, and Chevrolet with fuel injection. The Chevrolet engine with the three two-barrel carburetor now has a compression ratio of 11 to 1, highest of any stock motor car engine in 1959.

Bore/stroke ratio remains oversquare in keeping with the general philosophy of the short stroke principle.

Increased Torque

The ratio of torque/cu in. has increased slightly. The actual values of torque have gone up substantially in many cases but the ratio has not increased in the same proportion due to a general increase in displacements.

COMPARATIVE DATA

1959 OHV V-8 Passenger Car Engines

	BHP (max)	Displacement (cu in.)	Ratio BHP/ cu in.	Torque (lb ft)	Compression Ratio	Bore/ Stroke Ratio	Ratio Torque/ cu in.
CHEVROLET[3]	290	283	1.024	290	10.5	1.29	1.024
CHRYSLER[4] 300E	380	413	0.920	450	10	1.11	1.089
DE SOTO[4] Adventurer	350	383	0.914	425	10	1.07	1.109
CHEVROLET[1]	315	348	0.905	356	11.0	1.26	1.023
DODGE[4] Super D-500	345	383	0.900	420	10	1.26	1.097
PONTIAC[1]	345	389	0.887	425	10.5	1.08	1.092
CADILLAC[1] Eldorado	345	390	0.884	435	10.5	1.03	1.116
CHEVROLET[2]	250	283	0.883	305	10.5	1.29	1.077
CHEVROLET	300	348	0.862	350	11	1.26	1.006
RAMBLER Rebel	215	250	0.860	260	8.7	1.07	1.040
FORD	300	352	0.852	360	9.6	1.14	1.079
PONTIAC	330	389	0.848	420	10.5	1.08	1.079
DE SOTO Fire Flite	325	383	0.848	425	10	1.26	1.109
CHRYSLER Saratoga	325	383	0.848	425	10	1.26	1.109
CHRYSLER Imperial New Yorker	350	413	0.847	470	10	1.11	1.138
DODGE	305	361	0.845	400	10.1	1.21	1.108
PLYMOUTH	305	361	0.845	395	10	1.21	1.094
MERCURY	322	383	0.840	420	10	1.30	1.096
EDSEL	303	361	0.839	390	9.6	1.15	1.080
DODGE D-500	320	383	0.835	420	10	1.26	1.096
CADILLAC	325	390	0.833	430	10.5	1.03	1.102
AMBASSADOR	270	327	0.826	360	9.7	1.23	1.100
PLYMOUTH[5] Fury	290	318	0.817	345	9	1.18	1.085
THUNDERBIRD	350	430	0.814	490	10	1.16	1.139
LINCOLN CONTINENTAL	350	430	0.814	490	10	1.16	1.139
BUICK	325	401	0.810	445	10.5	1.15	1.109
MERCURY	345	430	0.802	480	10	1.16	1.116
OLDSMOBILE	315	394	0.800	435	9.75	1.11	1.104
STUDEBAKER[5]	195	259	0.753	265	8.3	1.10	1.023

NOTES: [1] Three, two-barrel (six-barrel) carburetor package.
[2] Fuel injection system.
[3] Fuel injection with special camshaft package.
[4] Two, four-barrel carburetor package.
[5] Four-barrel carburetor package.

At the present moment engine design remains quite conventional. The radical hemispherical chamber design, coupled with twin rocker arm shafts, has gone by the board in the search for simplicity and lower costs. All combustion chambers feature some version of a wedge-shaped configuration. Bores are larger consistent with the increase in displacement and are much larger than that of the general run of truck engines in past years.

There is a definite trend to weight reduction through improved design. Perhaps the most important trend is in the direction of simplification to reduce maintenance cost, and to make parts such as spark plugs and electrical components more readily accessible.

Economical Exhaust Systems

The pressure of economy has also affected the exhaust system. There is no rush in 1959 to feature dual exhaust systems, except on the larger and higher rated engines. Single exhaust not only is cheaper in first cost but it relieves the owner of a lot of expense when replacement must be made. It will be recalled that some years back when dual exhaust systems became popular, they were deemed important because of a positive gain in engine output. In fact, it offered an easy way of increasing horsepower without changing engine details.

Now we are told that continuing progress in engine refinement has reduced the margin of improvement that can be effected by a dual exhaust system. Hence, it is no longer as important. Moreover, it is felt that the single exhaust system is longer lived, in the main, because it operates at a higher temperature and has less condensation. So we are right back to where we were a few years ago.

Future Trends

It seems appropriate in completing this report to touch on some future trends in engine design. Certainly we all are conscious of the progress being made in the development of the gas turbine and the free piston engine. Moreover,

(*Turn to page* 128, *please*)

EXECUTIVE EARNINGS *in the* AUTOMOTIVE INDUSTRIES

By Richard W. Taylor
Associate, McKinsey & Co., Inc.

IN 1957, the automotive industries were doing fairly well. It was the fourth best year in history in terms of passenger-car production 6.1 million versus 7.9 million in 1955) and only slightly below 1956 in the total number of cars and trucks registered (9200 fewer units) when final results were tallied.

A more encouraging note was sounded for automotive parts manufacturers by the new peak in the number of vehicles on the road (61.2 million), a good measure of potential market size. This fact should be a welcome sign to the parts manufacturers since it indicates that the highly profitable market for replacement parts is continuing to expand.

But what concerns us here is: what effects have these and other cross currents had on executive compensation in the automotive industries? And how do these compensation levels in the nation's cornerstone industries compare with earnings paid to executives in other major industries? These and related subjects are discussed below in this year's report on what the automotive industries are paying their key executives.

COMPENSATION OF THE TOP MEN

Top executives in American industry, as a whole, continued to do well in 1957. On the average, top management's total compensation —including salary, bonus, and deferred compensation — increased slightly over the previous year. That is, 43 per cent of industry's chief executives received greater income in 1957 than they did in 1956, while 30 per cent received the same compensation, and only 27 per cent were paid less.

The average compensation in-

TABLE I

SALES, PROFITS, AND CHIEF EXECUTIVE COMPENSATION

1957 vs. 1956

Industries Used to Compute 18-Industry Trend Line	Average Percentage Increase or (Decrease) over 1956		
	Industry Profits	Industry Sales	Chief Executive's Compensation
Aircraft manufacturing	10.7%	24.3%	3.8%
AUTOMOTIVE PARTS	(1.6)	6.9	(1.2)
Building materials	(10.9)	(0.9)	(1.3)
Chemicals	1.7	5.7	0.2
Department stores	(0.6)	4.7	(6.5)
Electrical equipment	1.1	11.0	1.6
Food and beverages	(1.3)	3.8	0.9
Heavy machinery	0.4	7.5	(0.2)
Light machinery	0.8	8.4	(0.1)
Nonferrous metals	(32.7)	(8.2)	5.9
Paper and paperboard	(14.7)	0.5	(0.2)
Petroleum and natural gas	3.2	9.8	2.6
Public utilities	4.9	7.3	2.2
Railroads	(16.5)	0.9	3.1
Retail chains	2.0	5.0	(2.9)
Steel and iron	4.5	3.2	(4.3)
Textiles	(18.6)	3.8	(5.7)
Tobacco	12.3	9.1	9.9

THIS year's special analysis on executive compensation trends in the automotive vehicle and parts manufacturing industries was made by Richard W. Taylor of McKinsey & Co. His findings are based on reports submitted to the S.E.C. by 10 vehicle manufacturers and 41 parts manufacturers. These reports are part of an annual survey of 23 industries encompassing 642 corporations reported on by McKinsey & Company, Inc., in the September-October *Harvard Business Review*

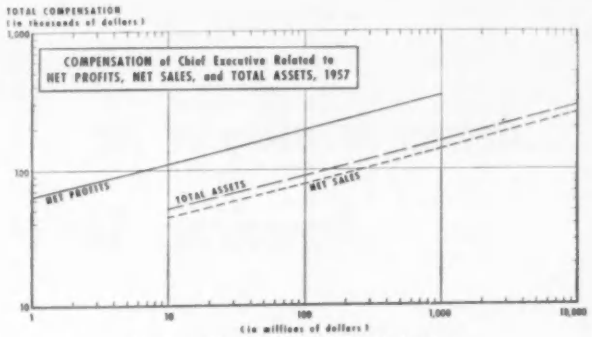


Fig. 1—Automotive Vehicle Industry

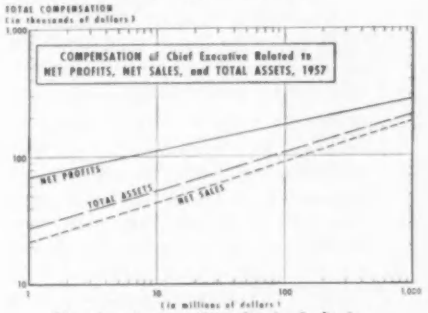


Fig. 2—Automotive Parts Industry

TABLE II

COMPENSATION OF OTHER EXECUTIVES AS A PERCENTAGE OF CHIEF EXECUTIVE'S COMPENSATION

	Vehicle Manufacturing	Average of 23 Industries	Parts Manufacturing
Second highest paid executive	80%	71%	68%
Third highest paid executive	67	59	57
Fourth highest paid executive	67	54	55

crease of the chief executives last year was 1.0 per cent, which represents a leveling off from the 5.1 per cent and 6.3 per cent increases chalked up in the two previous years.

In the automotive industries, the total compensation of chief executive officers in vehicle manufacturing companies increased a resounding 100 per cent, while automotive parts companies paid their chief executives 1.2 per cent less.

For the individual top men in these industries, however, the picture was quite different. In the vehicle manufacturing companies, 40 per cent of the chief executives received increases; an equal percentage received decreases; and the remaining 20 per cent remained unchanged. In the parts manufacturing companies, a greater percentage of the top men fared better in 1957—despite the over-all decrease in the group's compensation. Of these men, 46 per cent earned more than they did in 1956; 21 per cent earned less; and 33 per cent remained unchanged.

The objective of the annual McKinsey survey is to measure year-to-year changes in top-management compensation as related to company size and industry characteristics. "Company size" for this purpose is based on annual sales, total assets, and profits. Because vehicle and parts manufacturers compete in industry climates that differ somewhat, we have analyzed their compensation levels separately.

(a) Vehicle Manufacturers

Total net sales of the automotive vehicle manufacturers in 1951 increased 10.9 per cent over 1956. Only three of the 10 companies in the survey lost ground. Net profits rose even more, increasing 12.4 per cent, despite the fact that four companies reported net losses and four others showed profit decreases (thus two companies accounted for the upswing in profits).

These substantial increases in both sales and profits were reflected in the additional 10.0 per cent compensation paid to chief executives of vehicle manufacturers. This correlation of sales and profit results with top-management compensation levels is typical of the immediate responsiveness of this industry to profit gains. (The vehicle manufacturing companies pay large bonuses in high-profit years.) And the degree of correlation is reinforced by a similar responsiveness to profit decreases. For example in every case where executive earnings were decreased, profit-and-loss statements had red ink.

The mathematically fitted rela-

(*Turn to page* 95, *please*)

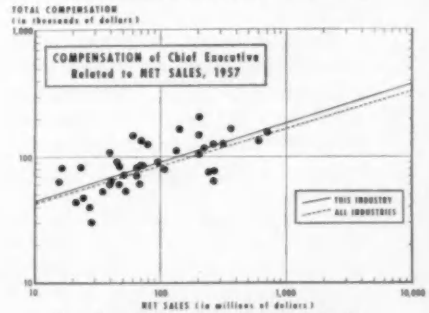


Fig. 3—Automotive Parts Industry (Represented by 40 Companies)

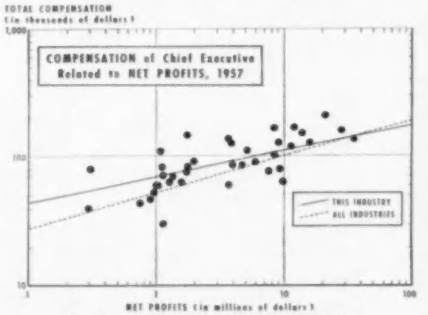


Fig. 4—Automotive Parts Industry (Represented by 38 Companies)

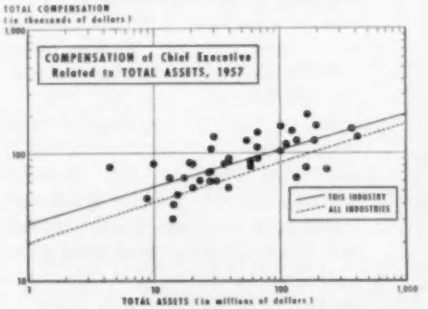


Fig. 5—Automotive Parts Industry (Represented by 41 Companies)

Annual Meeting of the

American Society of Body Engineers

By Joseph Geschelin

ALTHOUGH it is no longer necessary to prove that intimate cooperation among stylists, engineers, development, and manufacturing departments is essential, all of these relationships were emphasized by various speakers at the annual meeting of the American Society of Body Engineers, held in Detroit in October. Noteworthy too, was that basic materials—directly and indirectly—almost completely dominated the technical program.

Progress in the relatively young art of producing reinforced fiber glass molded parts was reported by Robert S. Morrison, president, Molded Fiber Glass Body Co. He referred to the Corvette body which marked the first successful production use of glass-reinforced plastic, noted that since the introduction of the Corvette his company has developed new materials and new finishing methods capable of reducing the cost of automotive painted exterior parts between 15 and 20 per cent.

Among the automotive applications of plastics up to now Morrison listed the following: Thunderbird removable hardtop; instrument panel for the Studebaker Hawk; instrument panel for the Studebaker-Packard (now out of production); simulated wood trim rails for Ford and Mercury station wagons; fenders for the forward control Willys Jeep; a large hardtop for a Willys Jeep; engine covers and housings for C-O-E's; fender skirts and fins for certain cars; fenders and grilles for limited production trucks.

As an example of the utility of the molded fiber glass process, it was noted that when the Chevrolet Cameo Carrier pick-up was first introduced, the rear quarter panels were made of reinforced fiber glass until the market justified the natural switch to steel panels with their high tooling cost. It may be noted incidentally that the new heavy duty GMC tractors announced October 22 feature molded fiber glass fenders in combination with the all aluminum cab.

Speaking of futures, Morrison drew attention to the versatility of plastic instrument panels for limited-production high priced cars. Such panels could be made with any degree of intricacy in a one-piece section at a relatively low investment for tooling. Moreover, it would be economical to make changes in panel design more frequently. A universal application, even on mass produced cars, is the use of plastic for rocker panels and fender skirts where corrosion takes its toll.

Finally, the speaker pointed to the possibilities of utilizing reinforced plastic parts in the structure of small cars of the future. Certainly in testing the market there would be greater economy in making many parts such as the underbody, hoods, deck, lids, body panels, etc., of plastic until the market justifies a switch to steel.

In a similar vein E. P. White, Aluminum Co. of America, envisioned the adoption of aluminum bumpers for motor cars to replace the chromium-plated steel bumpers now in use. In the first place, with the styling of today front bumpers weigh from 50 to 150 lb, while rear bumpers account for 40 to 50 lb. In aluminum bumper-grille combinations, there is a possible weight saving of 50 per cent or more.

Moreover, the versatility of aluminum and its associated fabrication techniques makes it possible to employ combinations of extrusions, forgings, and formed sheet together with a variety of textures that can harmonize or highlight any color treatment the stylists may visualize.

Besides the other ways of making bumpers, aluminum bumpers and parts have been made in both permanent mold and die cast forms. Recent developments in aluminum casting alloys have produced excellent elongation characteristics and premium strength.

However, one of the most important advantages of aluminum bumpers is in the superior physical properties for doing the job of a bumper. Because of lower modulus of elasticity, the aluminum bumper will absorb nearly three times as much energy as does steel. Even compared with modified high tensile bumper steel, aluminum will absorb 65 per cent more energy. Such bumpers will maintain eye appeal longer since, according to White, they will resist low speed impacts and local denting by stones.

For the advanced designs contemplated in the next two years, aluminum bumpers can be tailored so as to combine many new insert materials such as colored rubber, molded nylon, or plastics. Chrome-plated inserts can be employed to offer sharp contrasts with an etched or color-anodized aluminum surface.

We have noted in the past the pioneer work done by Ford Motor Co. in the development of plastic prototype study models. How this activity has grown in the interim was decribed by Arthur M. Tomchuck, Ford stamping process department. Currently about 90 per

(*Turn to page* 122, *please*)

News of the MACHINERY INDUSTRIES

By Charles A. Weinert

Many New Developments in Controls, Relays, Drives, Etc., Discussed at the 10th Annual Machine Tool Conference of the American Institute of Electrical Engineers

AIEE Holds Machine Tool Conference

Several interesting machine-tool product developments were revealed and described at the 10th Annual Machine Tool Conference of the American Institute of Electrical Engineers. They included a new multi-use numerically-controlled machine tool, a d-c water-cooled spindle motor, and a semiconductor rectifier.

Held this year in Hartford, Conn., on October 13-15, the meeting had an attendance of about 700. Both builders and users of machine tool equipment were well represented. Executives and engineers came to the conference from companies producing machine tools, automobiles, aircraft, automotive components, electrical control systems, and electrical components, among numerous others.

The three-day meeting program had 14 technical paper presentations. Additional features comprised a panel discussion on designing machine tools for servo drives, a series of six five-minute talks on new electric products for machine tools, and visitations to three local plants.

Subjects of the technical papers, in addition to those mentioned above, were: Operating experience with numerical control, static switching versus relays, gaging applications, and tubes versus transistors in machine tool control. Power supply systems, magnetic control reliability, and missile component manufacture were among other subjects on the agenda.

Numerically-Controlled Multi-Use Machine

The unveiling of an entirely new concept in a numerically-controlled machine tool took place at the meeting. It was heralded as bridging the gap between toolroom methods and automated transfer lines. The self-contained machine can automatically mill, drill, bore and tap, and in addition can perform some profiling, such as circular arcs and slopes.

The make-up and economics of the Milwaukee-Matic, as it is called, were outlined in a presentation by W. E. Brainard, Kearney & Trecker Corp. Its most novel feature is a circular automatic tool changer, or magazine, which can hold 30 different tools. Operating in conjunction with the changer is a transfer arm which rotates between the spindle of the machine and the changer. On the initial half-turn of the arm, the old tool is withdrawn from the spindle and a new tool removed from the changer. The arm then rotates another half-turn, inserting the new tool in the spindle and at the same time placing the old tool in the changer. Then the transfer arm pivots out of the way of machine operation.

The particular machine described will handle a workpiece which could be contained within an 18-in. cube. Its rotary table automatically indexes to present the workpiece surfaces to the spindle which moves longitudinally and vertically, as well as to depth. Tools are changed in 8½ sec. Feed rates are from 1 to 99 ipm, tape-selected in increments of 1 ipm. Spindle speeds are from 100 to 4000 rpm, tape-selected in increments of 10 rpm.

General Electric Co. developed the control system for the machine. It controls feed and traverse rates in three axes, spindle rpm, tool selection and change, table indexing, coolant, etc. Tape preparation is of simplified form, being done on a conventional typewriter and in a manner similar to that used for single-spindle screw machines. At the machine the tape is read by a mechanical-type Commercial Controls tape reader. A small analog computer does the interpolation where required for arc and slope generation.

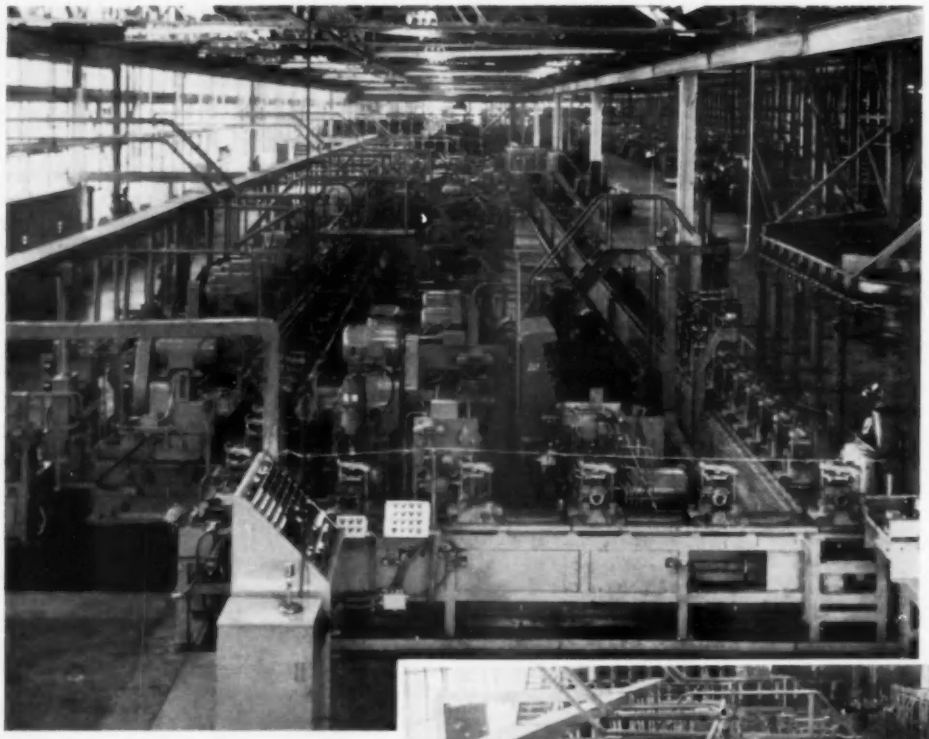
Watercooled Spindle Motor

A new design of d-c watercooled shell-type spindle motor, having an infinite speed range from 50 to 6000 rpm, was described by A. P. Bowman, Allis-Chalmers Mfg. Co. The motor, together with its controller, was developed in coordination with Ekstrom, Carlson & Co. for a new line of contour milling machines. Prime objective was to provide a machine which could process titanium at 50 rpm, steels at 200 rpm, and aluminum at 6000 rpm—or, in other words, handle with one machine the varying speed requirements of the different materials.

The prototype motor has a rating of 0.33/10/10 hp at 50/1500/6000 rpm. In order to produce added torque at lower speeds, a 16 to 1 backgear is used with the motor, being placed into operation at speeds of 240 rpm and below.

Outer frame of the motor serves both as the supporting structure and outside shell of the cooling-water jacket. The water jacket is either cast aluminum or iron, and contains a helical groove through

(*Turn to page* 68, *please*)



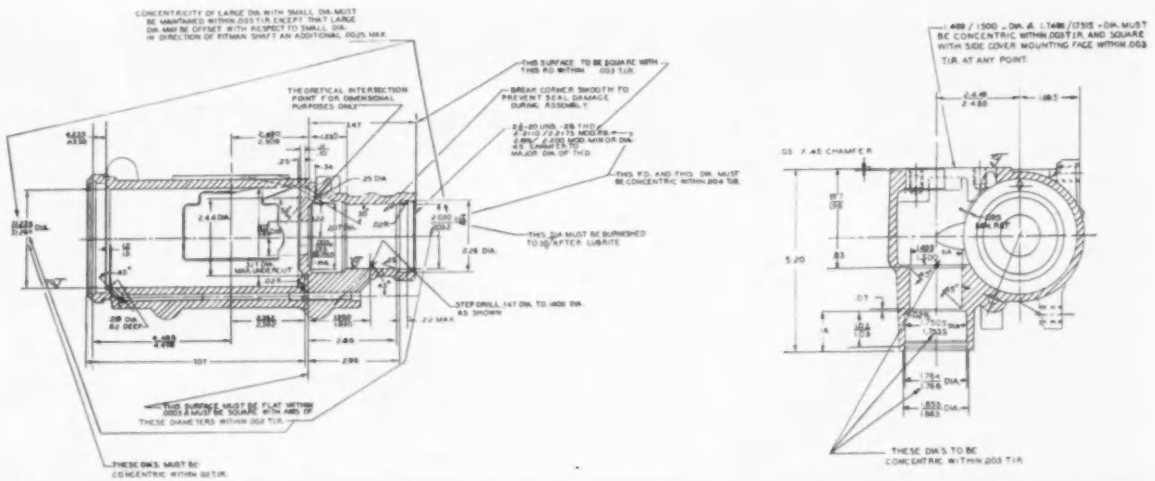
Long perspective of the big Greenlee transfer machine, running some 219 ft in length. The conveyor at the right is the return for pallets.

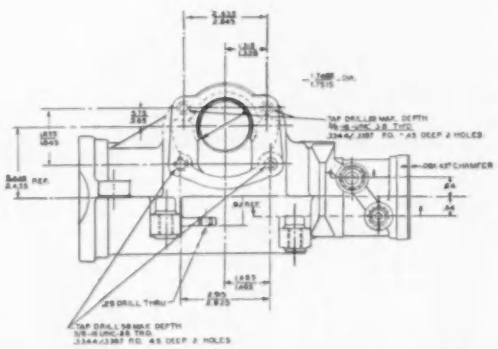
Close-up of stations near the end of the Greenlee line.

Power Steering Gear Housing Machined in One Cycle

THE malleable iron gear housing for the 1959 power steering gear manufactured by Saginaw Steering Gear Div., GMC, is machined completely in one cycle in the huge Greenlee transfer machine illustrated here. The basic Greenlee machine was installed some time ago for the machining of the gear housing used in the 1958 product. Although the new gear has been completely redesigned, substantially the same transfer machine is being employed. To accommodate the changes in product design, however, the machine has been rebuilt and converted to handle the new housing primarily by the replacement of a number of heads, several slides, and the introduction of a number of entirely new units.

The facility with which this enormous transfer machine has been altered to handle a radical change in products speaks well for the flexibility of modern equipment.





Drawings of the 1959 gear housing, showing principal cross - sections, fully dimensioned to indicate the character of dimensional tolerances.

The point is that the change has been effected at a cost that represents only a fraction of the initial cost of the installation.

It is of interest that the Greenlee machine handles approximately a ton of housings in the system at one time.

An exterior view of the housing as well as two principal cross-sections are reproduced here to indicate the character of dimensional tolerances that must be maintained. Because of the nature of the assembly contained in this housing flatness and concentricity are among the most important considerations. For example, it will be noted in the longitudinal cross-section that the end face must be held square with the thread PD within 0.003 in. total indicator reading. Similarly the end face within the cavity must be flat within 0.0005 in. and square with the axis of the cavity diameters within 0.002 in. total indicator reading.

Turning to the transverse cross-section, it is noteworthy that the two principal pilot diameters must be concentric within 0.003 in. total indicator reading, and square with the side cover mounting face within 0.003 in. total indicator reading at any point.

These requirements plus the specified tolerances on dimensions spell out the compelling reason for the adoption of a transfer machine of pallet type. Here each individual part is securely clamped in a massive fixture and remains in the same fixture for the entire cycle. Before the adoption of the Greenlee machine housings were routed over a large number of individual machines, requiring a shift from one fixture to another. The requirements of the new housing are so exacting from the standpoint of quality control that older methods are no longer adequate.

The Greenlee transfer machine illustrated here has 30 work stations, one idle station, three automatic inspection stations. In addition, the machine has 11 points at which probes come in automatically to search for broken drills ahead of tapping heads. It has 44 heads and runs 219 ft in length. There are 140 operations performed along the line, employing some 124 tools of various kinds. At 80 per cent efficiency the machine will produce at the rate of 240 pieces per hour.

This machine features 91 motors, providing a total of 633 hp. Some impression of the complexity of the accessory equipment may be gained from the following statistics: 54.6 miles of wiring harness; 316 limit switches; 239 pushbuttons; and 524 contactors, relays, and timers. The hydraulic circuit, in turn, contains a total of 6200 ft of tubing.

A brief summary of major operations, by types, is as follows: 12 milling; 20 boring; 44 drilling; four bore and face; 14 bore and chamfer; six recessing; two recess and chamfer; 30 chamfer; and 14 tapping.

To handle the special requirements of the new housing, it was found necessary to add a small Saginaw-designed transfer machine on a line parallel to the big unit.

(*Turn to page* 120, *please*)

• • • • • Trends in the CONSTRUCTION EQUIPMENT INDUSTRY

Equipment Sales Increase

Construction equipment manufacturers seem satisfied that their business has definitely begun the climb out of the doldrums in which they found themselves during the latter half of 1957 and beginning of this year. Most of them report that sales began to pick up substantially during June and July, and are continuing to increase as of now. Some manufacturers suggest that the dollar volume of business during the third or fourth quarters of this year may reach an all-time high. ■

Progress in Highway Construction

Speaking before SAE's Farm, Construction, and Industrial Machinery meeting in Milwaukee in September, Boyd S. Oberlink, Allis-Chalmers Mfg. Co., and president of Construction Industry Manufacturers Assn., told the group that the states collectively were a few percentage points ahead of schedule on the Interstate Highway System, but that some state highway departments, responsible for planning, engineering, right-of-way acquisition, contract awarding, construction supervision, etc., were lagging. About 6000 miles of the proposed 41,000-mile system were considered to be complete and up to standard when the program started; 1952 miles additional had been completed as of the end of July of this year, and 3159 miles of road were then under construction. Thus about 5000 miles of the 35,000 miles of Interstate Highways to be brought up to minimum standards were completed or under construction. In addition to this construction, contracts have been awarded for 4868 miles, and another 1898 miles have been programmed.

In the ABC System, construction has been completed on 44,786 miles of road since the beginning of the program, and work was underway on 23,150 miles as of end of July.

Gross highway construction, including all Federal, Federal aid, state, and local construction, and with estimates of future construction through 1962, shows a 70 per cent increase from 1955 through 1962. If adequate funds are available, there should be another 10 years of very high level activity in the highway construction field. ■

News of the MACHINERY INDUSTRIES

(*Continued from page* 65)

which the water flows. The inner shell of the jacket is the magnetic yoke of the motor.

New Rectifier

The silicon controlled rectifier, described as a semi-conductor thyratron, was introduced by W. D. Cockrell, General Electric Co, as a promising new device for the control of electric power. First built less than a year ago, it is only now emerging from the laboratory to the company's pilot production line. The device at present is made in two sizes, a nominal 16-amp rating and a 50-amp rating. Larger sizes are in prospect.

In the opinion of Mr. Cockrell, the silicon controlled rectifier with its inherent advantages will complement and, to some extent, replace thyratrons and ignitrons. Among its advantages are small size, long life, and low internal losses. Since it has no heated cathode, it requires no standby power, and is instantly available with no heat-up time required. It may be mounted in any position, inasmuch as it contains neither mercury nor gas.

Experience with Magnetic Controls

Well-kept records of trouble-shooting, using IBM tabulating equipment, are paying off for at least one user. L. S. Thomas of Pontiac Motor Div., General Motors Corp., explained the system being used by his company to pinpoint which types of electrical failures are the most recurrent, so that a concerted effort can be made to reduce them.

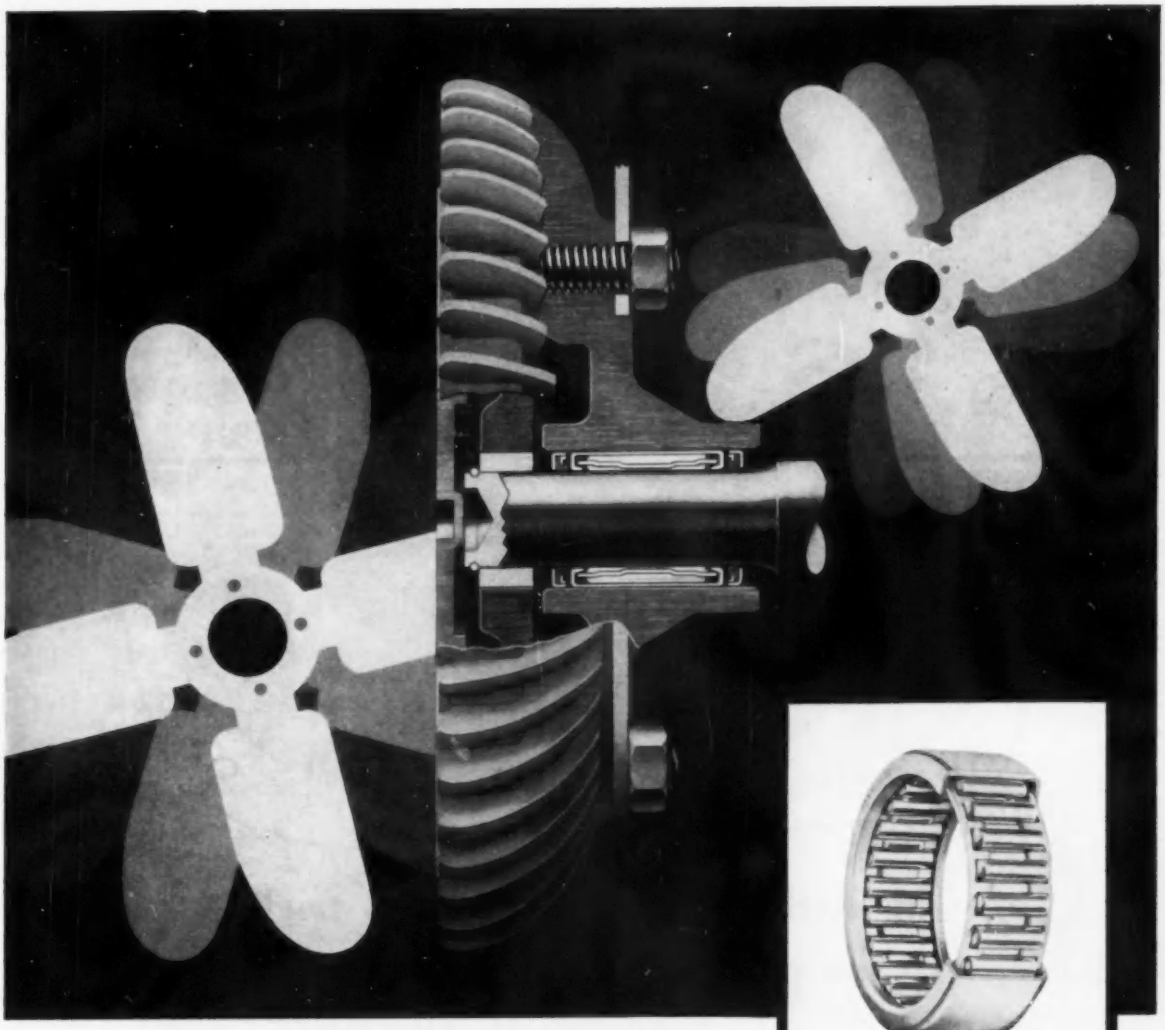
Based on his experience, he suggested that more attention be given to design details of limit switches. Also that they should be better-protected against harmful operating conditions.

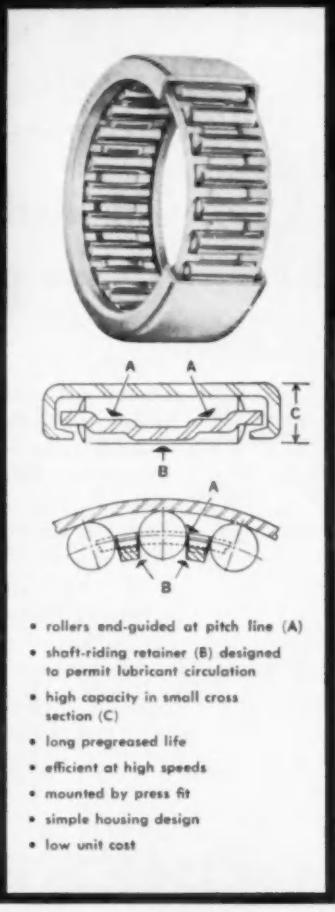
Solenoids and solenoid-controlled valves were next on the trouble list. The speaker had no ideas for correction aside from providing proper interlocking and protection against unfavorable operating conditions, but expressed the opinion that there was room for improvement.

Numerical-Control Operating Experience

W. D. Beeby of Boeing Airplane Co., Wichita Div., gave some of the results of a full year of experience with three GE-controlled

(*Turn to page* 132, *please*)





- rollers end-guided at pitch line (A)
- shaft-riding retainer (B) designed to permit lubricant circulation
- high capacity in small cross section (C)
- long pregreased life
- efficient at high speeds
- mounted by press fit
- simple housing design
- low unit cost

Schwitzer Variable Speed Fan Drive features new Torrington Bearing for economy, stability, lifetime lubrication

The original design of the Schwitzer Fan Drive, used in passenger automobiles to reduce fan horsepower and noise, called for two ball bearings. By replacing these with one Torrington Drawn Cup Roller Bearing, Schwitzer engineers have simplified the design and reduced costs.

This unique bearing firmly supports the drive housing and fan so they run true despite possible couple loads due to gyroscopic action. Ample lubricant reserve capacity permits pre-lubrication for the life of the fan drive.

Many new opportunities for economy, design simplification and operating improvements are opened up to engineers and designers by the new Torrington Drawn Cup Roller Bearing. Services of Torrington's engineering staff are offered to help you with product development work. **The Torrington Company, Torrington, Conn.—and South Bend 21, Ind.**

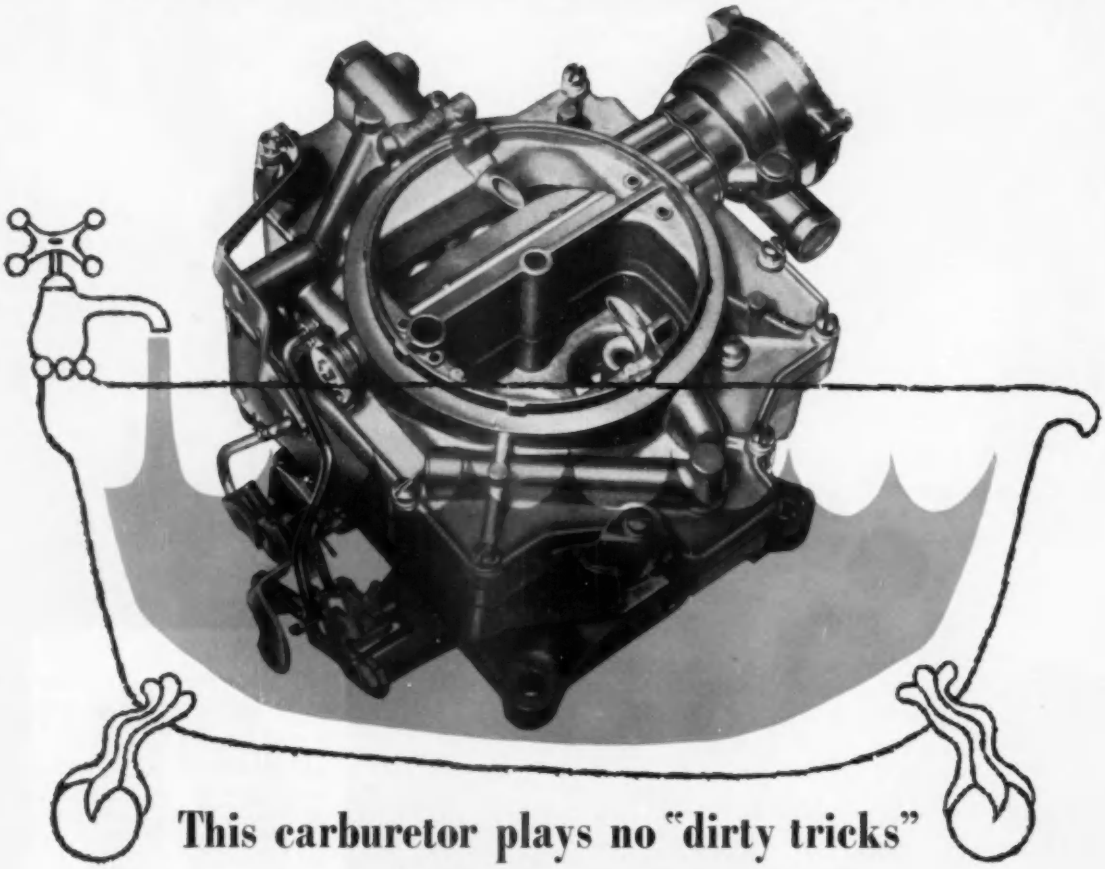
TORRINGTON BEARINGS

District Offices and Distributors in Principal Cities of United States and Canada

NEEDLE • SPHERICAL ROLLER • TAPERED ROLLER • CYLINDRICAL ROLLER • BALL • NEEDLE ROLLERS • THRUST

WHY ROCHESTER-GM CARBURETORS ARE

AMERICA'S NUMBER ONE ORIGINAL EQUIPMENT CARBURETORS!



This carburetor plays no "dirty tricks" on performance or economy!

There's not a speck of trouble in a Rochester-GM Carburetor. One reason is the thorough washing float bowls, throttle bodies and air horns get before assembly. Special Centri-Spray circular index washers penetrate every hole to remove every particle of dirt. Rochester-GM Carburetors emerge spick and span, ready to deliver sparkling, trouble-free performance. This is just part of the extra care . . . the extra quality you get in a Rochester-GM Carburetor. And it's another big reason why Rochester-GM Carburetors are America's number one original equipment carburetor. *Rochester Products Division of General Motors, Rochester, New York.*

GM
GENERAL MOTORS

America's number one original equipment carburetors

ROCHESTER CARBURETORS

THERE'S A COPY FOR EVERY TOOL ENGINEER IN AMERICA

MAIL THE COUPON FOR YOUR COPY

The story of Pioneer 921-T *Direct Chilled* Aluminum Tooling Plate is too big, too new, too full of interesting data, figures and illustrated applications to be told on this single page. Tool and design engineers may have the entire story by mailing the coupon below for a copy of the new 921-T brochure. Just tell us who and where you are, and we will send you the book by return mail without cost or obligation.

PIONEER
ALUMINUM INC.
Subsidiary of MORRIS P. KIRK & SON, INC.
Pacific Coast Unit of NATIONAL LEAD CO.
5251 WEST IMPERIAL HIGHWAY — ORegon 8-7621
Los Angeles 45, California

SNIP, TEAR OR CHOP OUT THIS COUPON AND MAIL

PIONEER ALUMINUM INC. AI 11-8
5251 WEST IMPERIAL HIGHWAY, LOS ANGELES 45, CALIFORNIA

Send me the full story of Pioneer 921-T DC by return mail.

NAME _____

FIRM _____ DEPT _____

ADDRESS _____

CITY _____ STATE _____

Circle 136 on Inquiry Card for more data

FASTENING SPECIALTIES BY *National*

Get more dependable holding power for better product assembly with these National SPECIALTY FASTENERS!

Lok-Thred® Bolts, Studs, Screws—Seal and lock against involuntary loosening... Lok-Thred re-forms the metal of the receiving thread under high compressive stresses into intimate contact with itself, eliminating all voids. Yet, it's fully re-usable. Requires no selective fits. Can be used with ordinary tools. Available in all sizes of bolts, studs, screws... No. 6 or larger.

Spin-Lock® Fasteners—Give you strength at low cost, with self-locking, ratchet-tooth action... Spin-Lock machine and tapping screws have angled teeth to permit fast, easy tightening. They require about 20% greater torque to loosen. Available in pan, truss, flat and hex heads; slotted or Phillips recessed heads; No. 4 to $\frac{3}{8}$" diameters, lengths from twice diameter and up.

Thread Cutting Screws—For joining metals or plastics without tapping... Use wherever it is desirable to remove rather than displace thread material. Four types: 1, 23, 25, and F cover most applications. Phillips or slotted heads, all styles, all sizes. Also type A and B tapping screws for fastening light sheet steel or light gauges of other metals.

Lock Nuts—Three types, to meet every requirement... 1. *Huglock*, for locking without seating and under adverse conditions. 2. *Marsden*, free-running until seated... for minimum-cost locking. 3. *Drake*, a two-piece design for use under severe stresses, shock, vibration. All types are all-metal, fully re-usable without loss of positive locking action.

Welding Fasteners and Weldnuts—Provide trouble-free assembly of fabricated metal parts... Use National welding fasteners when primary fasteners must be cleanly welded into exact position. National's complete line of projection welding screws and nuts is available in stock sizes, for optimum welds in materials .030 to $\frac{1}{4}$" thick. We will develop special designs for you.

Flex-Head® Locking Screws—Self-locking, highly resistant to fatigue, shock, impact... Tight locking results from flexing of the head and axial spring tension produced when fully torqued against a rigid seat. Flex-Head screws are identical in dimension, and interchangeable with standard machine screws. Made of 1022 steel and heat-treated for top strength.

Tuff-Tite® Cushioned Fasteners—Seal openings, eliminate vibration noises, absorb shock... Pre-assembled neoprene washers also prevent finish marring! Available as tapping screws, thread cutting screws, machine screws, roofing bolts, stove bolts, or wood screws; with Phillips or slotted heads; pan, round, truss or hex head styles.

Place® Bolts—Self-locking...resist impact, shock and fatigue failure by controlled spring action of reinforced, diaphragm head... Place bolts resist involuntary loosening when rigidly seated. Typical uses: connecting rod bolts, main bearing cap screws, flywheel bolts. Available in high carbon or alloy steel, in a wide range of sizes.

Save yourself time and trouble in searching for the right fastener. Make National your *one source* for standards, specialties and special designs. Our standard line includes all types and sizes... nuts, cap and set screws, machine bolts, carriage, step and elevator bolts, plow bolts; Phillips recessed head, or slotted, Sems, machine screws, wood screws; stove bolts, pipe plugs, cotter pins and rivets.

National can supply any nonstandard fastener, or design and produce specials for you. Write for National's *Special Products* booklet, or for information on the fastening specialty that interests you.

THE NATIONAL SCREW & MFG. CO. • CLEVELAND 4, OHIO

***Pacific Coast:* National Screw & Mfg. Co. of Cal. • 3423 South Garfield Ave., Los Angeles 22, Cal.**

National PRODUCTS

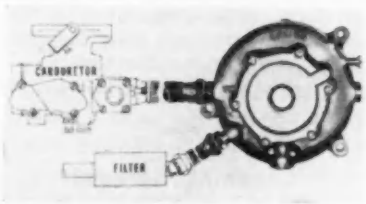
Fasteners  **Hodell Chains**  **Chester Hoists** 

NEW PRODUCTS AUTOMOTIVE-AVIATION

FOR ADDITIONAL INFORMATION, please use reply card at back of issue

Vapor LP-Gas System

Pictured is the Ensign Model VW two-stage vapor phase LP-gas regulator designed for small tractors and other small engine applications where



vapor is feasible. The regulator uses LP-gas vapor off the top of the fuel tank.

Including both stages of pressure regulation, the first stage regulator reduces pressure from that encountered in the fuel tank down to approximately 4 psi. The final stage regulator reduces pressure to slightly below atmospheric to assure complete lock-off of fuel when the engine is stopped. The unit may be mounted in any upright position. *Ensign Carburetor Co.*

Circle 31 on postcard for more data

Ultra-Small Micro Switch

An ultra-small quick-disconnect switch rated at 10 amp, 125 or 250 vac; ½ amp, 125 vdc; ¼ amp, 250 vdc can be attached in seconds, speeding up production line assembly. The contact arrangement is single-pole double throw and the switch may be wired normally open or closed. A variety of roller and lever type auxiliary actuators may be easily attached for applications where the operating direction is not in-line with the plunger motion. *Minneapolis-Honeywell Regulator Co.*

Circle 32 on postcard for more data

Anodic Coating

A clear anodic coating for magnesium alloys that can be applied in less than one minute has been developed by the Dow Chemical Co. It is used under a lacquer or varnish for maximum corrosion protection. The anodic treatment can be applied to all forms of magnesium, such as sheet, extrusions, die-castings, sand castings and forgings.

Circle 33 on postcard for more data

Piston Type Pumps

A line of constant pressure, variable displacement, piston type hydraulic pumps has been designed for use in high-temperature applications on aircraft and missile hydraulic flight control systems.

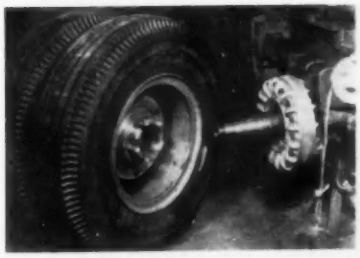
The pump design features increased reliability at high operating speeds, insensitivity to type of fluid used, high-temperature bearings, all-metallic O-rings and seals, and a minimum of rotating parts. Available with either single or dual pumping ele-

ments, the pumps are designed to run at temperatures up to 7500 rpm and are for use with fluid temperatures up to 550 F and ambient temperatures up to 600 F. *Pesco Products Div., Borg-Warner Corp.*

Circle 34 on postcard for more data

Disk Brakes

This disk brake has been designed to dissipate heat generated when stopping or slowing a vehicle through the use of a liquid coolant. It has a disk with two fricton surfaces that turns the wheel. When the brakes are applied, two liquid cooled pressure disks are moved into contact with the turning friction disk to stop or slow the vehicle. The liquid coolant in the pressure disks is circulated by a pump, through the brake to the radiator cool-



ing system where the heat, generated while stopping or slowing, is dissipated. The brake, itself, remains sufficiently cool to stop the vehicle. *Wagner Electric Corp.*

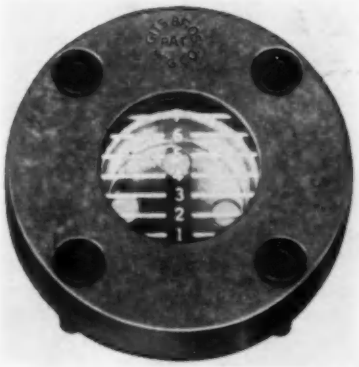
Circle 35 on postcard for more data

Gear Case Oil Gages

A series of screw-mounted gear case oil gages has been introduced by Gits Bros. Mfg. Co. Designed for aircraft applications, the gages permit an instant check of the oil level within transmissions or gear case. The standard line comes in five sizes, with sight diameters from ¾ to 2 in.

The sight is backed with a cadmium plated reflector which reflects the oil level and the mounting flange is fitted with an oil-tight gasket.

Circle 36 on postcard for more data



Sealed Beams

The 6412 is a new, ruggedized, Vision-Aid sealed beam headlamp for use on heavy duty truck and bus equipment and the 6006 and 6012 regular 6 and 12 v versions are for improved passenger car use.

Designed to be interchangeable with any 7-in. sealed beam headlamp, the Vision-Aids are intended to make existing two-beam systems as efficient on the low beam as the four lamp headlighting systems. The lamps project a concentrated "spotlight" beam pattern down the right side of the road eliminating the "blind spot" or cancelling out effect of opposing headlights. *Tung-Sol Electric Inc.*

Circle 37 on postcard for more data

Contour Cushion Seat

A contour cushion seat designed for trucks, buses, road machinery and other heavy duty mobile equipment has been announced by the Milsco Mfg. Co. The seat is built on a sturdy steel base and is heavily padded with four inches of foam rubber at the back.

Circle 38 on postcard for more data

Spark Plug Socket

Known as the Plug-Mate, this magnetic spark plug socket has been designed for easy removal and installation of spark plugs. The deep-well, thin walled 13/16 in. socket has a built-in magnet to secure the plug by the shell. This permits the insulator to be free of metallic contact with the

socket and thus lessen the chance of breaking during installation. *Champion Spark Plug Co.*

Circle 39 on postcard for more data

Hatchway Limit Switch

Type HDH hatchway limit switches are designed for industrial, marine and naval use. They embody one or two cam-operated, spring-closed slow acting switching elements. Switching elements are easily adapted for one

or two normally closed circuits, one or two normally open circuits, or one normally open and one normally closed circuit.

The switch is rated up to 600 v at a maximum continuous current of 25 amp, ac or dc. Travel limits are 45 degrees in either direction. *Westinghouse Electric Corp.*

Circle 40 on postcard for more data

Powder Metal Bearing

Comprised chiefly of iron powders, a new powder metal bearing can be used on a wide range of products where corrosion is not a problem and mechanical strength requirements are within tolerable limits. A high oil content—nearly 20 per cent by volume—asures the bearing a sufficient supply of oil to make it self-lubricating for the lifetime of many end products. *Amplex Div., Chrysler Corp.*

Circle 41 on postcard for more data

Mobile Test Set

The Consolidated electronic test set is composed of a group of high-quality basic instruments. Known as the DataTape Type 23-203 Test Set, the unit is designed to carry out fast, accurate adjustments and measurements on CEC's 5-752 Magnetic-Tape Recorder/Reproducer. Such operations as frequency response measurements of record and reproduce amplifiers, measurement and adjustment of magnetic-head record and bias current and amplifer input/output levels, calibration of FM record amplifiers, etc., are handled. *Consolidated Electrodynamics Corp.*

Circle 42 on postcard for more data

Check Valves

Check valves, designed for rugged operation in hydraulic systems up to 5000 psi have been announced by Denison Engineering Div., American Brake Shoe Co. They come in both the subplate and sandwich types.

Principal function of the valves in hydraulic systems is to block oil flow in one direction yet allow free flow of oil in the reverse direction.

Circle 43 on postcard for more data

Cleaning Solvents

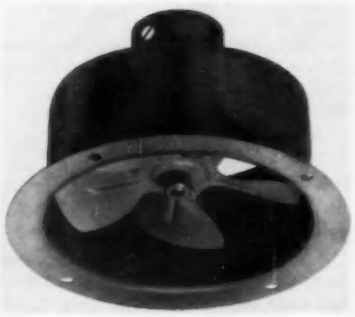
Cleaning of large electric motors may be accomplished by on-site use of nonflammable, non-explosive, and virtually non-toxic "Freon" solvents. "Freon" solvents will not attack insulating materials and varnishes used on motor windings. They permit in-place cleaning rather than requiring the dismantling of the motor for repair shop cleaning. *E. I. DuPont DeNemours & Co.*

Circle 44 on postcard for more data

Axial Blower Unit

A series of tubeaxial blower units has been designed for cooling electronic panels in computers, radio, military electronic equipment, etc. The basic blower unit is 6 in. in overall diameter, 4 in. long, weighs 16 oz, and can deliver from 50 to 160 cfm. Variations in unit size and air output can be made, and the motor may be either ac or dc. *Torrington Mfg. Co.*

Circle 45 on postcard for more data



New Developments in Production Equipment

High-Velocity, High-Energy Machine Tool

This metalworking machine tool, developed by Convair Div. of General Dynamics Corp., was displayed for the first time at the 40th National Metal Exposition in Cleveland, Ohio. Named Dynapak, the machine may be used for high energy-rate extrusion, forging, sheet metal forming, compacting of ceramics and powdered metals, as well as for shearing and blanking. Heavy dynamic reaction plate held by three tie bars at right in Fig. 1 positions the die against which the piston at left reacts with tremendous velocity and pressure. The control console in the background has one dial by means of which the Dynapak is cycled for firing and reset. Small and compact for its strength, the machine may be bench mounted or secured to a concrete factory floor by just four bolts.

Figure 2 shows the principle of pneumatics on which the machine is based. The chamber at left is for high pressure gas. Relatively low gas pressure in chamber at right forces the piston against the orifice plate, and a seal in the piston plate isolates all of the piston surface from the high-pressure gas except the small area surrounded by the seal. As long as the high pressure acting on the small area and the low pressure acting on the large area are in balance, the machine is described as "set for firing." Application of a slight additional pressure to the high pressure chamber at the left starts the piston moving, disengaging the seal around the small hole in the orifice plate and permitting the high pressure gas to push against the entire face of the piston. This greatly overbalances the low pressure in the chamber at the right, moving the piston at velocities of as much as 2500 fps. Speed is dependent upon the size of the cylinder and the pressure employed in the two chambers. Dynapak machines can develop energy levels of as much as 1,500,000 ft-lb.

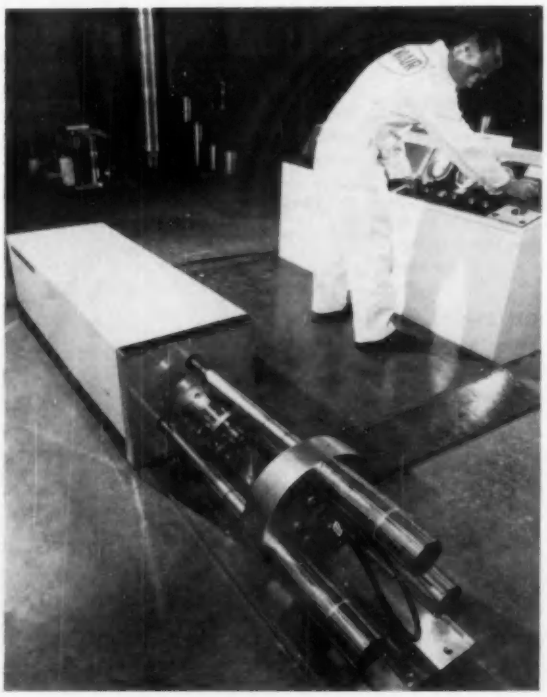


FIG. 1

Convair's Dynapak high-energy machine tool for extrusion, forging, sheet metal forming, compacting of ceramics and powdered metals, shearing and blanking

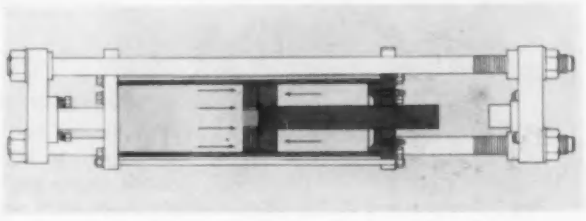


FIG. 2

Sketch showing the principle of pneumatics on which the machine is based

Following are two additional descriptions, in brief, of products that were on display for the first time. AUTOMOTIVE INDUSTRIES featured, in the October 15th issue, many other new products and developments exhibited at the show.

Metal Parts Conditioning

Another device displayed for the first time was the Vibra-Washer. This machine was designed to automatically clean or process ferrous or non-ferrous machined parts, stampings and small castings at high production capacities. The vibrating assembly, mounted on the work carrier, provides gentle yet thorough agitation of parts and solution. The turbulent action causes the parts to "swim" along the carrier, forcing the solution into every opening—even blind drilling.

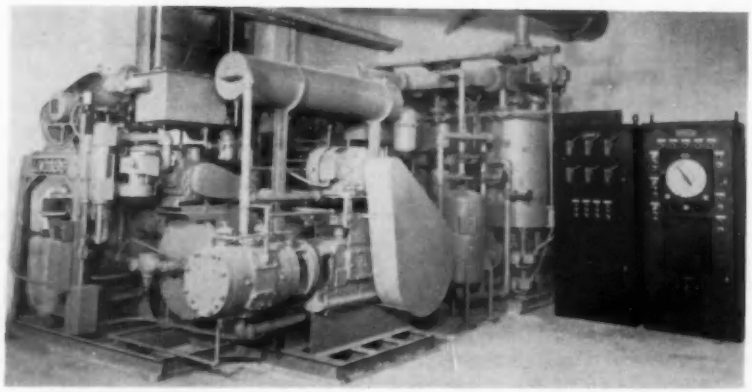
As parts reach the end of the work carrier, they are received by the flight conveyor and automatically removed from the machine for packing or further processing.

The machine will handle up to 10,000 lb of parts per hour, depending upon the setting of the variable-speed assembly. Parts may be handled ranging in size up to six inches.

(Turn to page 138, please)

NEW PRODUCTION and PLANT EQUIPMENT

FOR ADDITIONAL INFORMATION, please use reply card at back of issue



Lindberg nitrogen generator packaged unit completely piped and wired

Packaged Generator Unit For Nitrogen Atmospheres

THIS nitrogen generator packaged unit completely piped and wired for the production of nitrogen atmospheres by combusting a mixture of air and natural gas is automatic, once started.

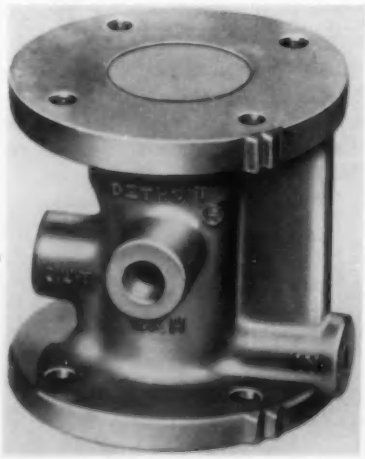
The atmosphere produced is CO_2-free, dry combusted gas which may be varied from rich to lean ratios of the air-gas mixture of the exothermic generator. The generator can also be operated on the oxidizing side to eliminate all combustibles, if desired.

The atmosphere produced can be used for any application where a high nitrogen, CO_2-free, dry atmosphere is required, such as heat treating and melting fields of the metals industry. *Lindberg Engineering Co.*

Circle 60 on postcard for more data

Air Valve Adapter

KNOWN as the "P" adapter, an air valve development which extends the time delay of standard sequence heads is available from Ross operating Valve Co.



Ross "P" adapter extends time delay

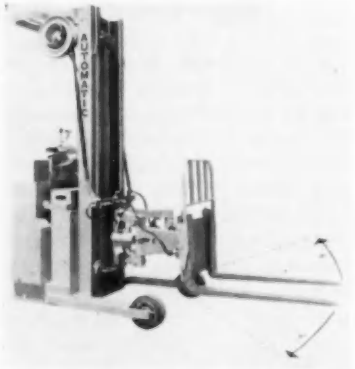
The new pilot section expands the scope of timing by air by making available accurate time delays of up to one minute. It is designed to work in combination with the Ross Graymodel TD head and any body in the Skyline series.

Individual pressure can go directly to each of the three working components or pressure can be supplied in any combination of hookups. A modification available makes it possible to supply pilot air from the valve body, through the adapter to the head.

Circle 61 on postcard for more data

Narrow Aisle Truck

DEVELOPED for narrow aisle problems, the "Transveyor," a swing reach truck, projects the forks forward to reach out for the load and swing in unison, right or left of center up to 30 degrees. The truck is



"Transveyor," swing reach handling truck

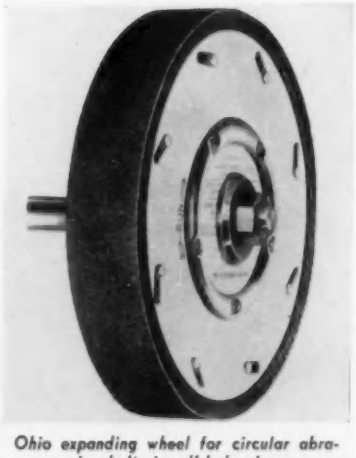
available in 2000, 3000 and 4000 lb capacities. *Automatic Transportation Co.*

Circle 62 on postcard for more data

Expanding Wheel

THIS expanding wheel for circular abrasive belts is self-balancing and maintains a flat edge, so that it can be used for such work as polishing, tool grinding and rough deburring. The wheel has a floating action which frees it from edge distortion due to centrifugal force, and allows it to achieve dynamic balance in operation. *Ohio Rubber Co.*

Circle 63 on postcard for more data



Ohio expanding wheel for circular abrasive belts is self-balancing.

Miniature Circuit Breaker

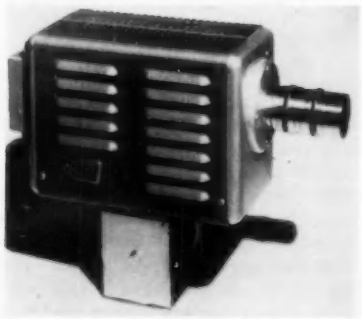
THE Model 45-700-P miniature circuit breaker is designed to eliminate accidental circuit interruptions. The unique trip-free mechanism prevents breaker reset while overload conditions prevail. Depression of the reset button will not interrupt the circuit once the breaker is closed. The device provides protection for such applications as appliances, tools, motors, electronic equipment and other electrical devices. *E-T-A Products Co. of America.*

Circle 64 on postcard for more data

Automatic TV Camera

MODEL 63A is a completely self-contained automatic television camera for industrial applications. It accommodates a light range of 120 to 1, with 50 per cent change in video output level. This is equivalent to automatic adjustment of lens stops from f/1.5 to f/16.

In addition, it automatically self-adjusts beam, target and electrical focus circuits to optimum values. The



Dage self-contained television camera

unit weighs 10 lb and measures 6¾ in. high by 5⅛ in. wide by 11 3/16 in. long. *Dage Television Div., Thompson Products, Inc.*

Circle 65 on postcard for more data

Correcting Attachment

A TAPER correcting attachment applicable to Cincinnati Filmatic Centertype Grinders up to 48 in. length can be applied to the company's 4 to 14 in. plain grinders and on all sizes of their universal grinders. It is employed primarily to obtain exact alignment of the swivel table, thereby eliminating uncertain "cut and dry" methods when grinding the work to precise accuracy of straightness. *Grinding Machine Div., The Cincinnati Milling Machine Co.*

Circle 66 on postcard for more data

General Purpose Heavy Duty Press Type Spot Welder

Federal Machine and Welder general purpose heavy duty press type spot welder. It has universal arms and a closed water cooling system. Foot switch starts the weld sequence which is automatic.

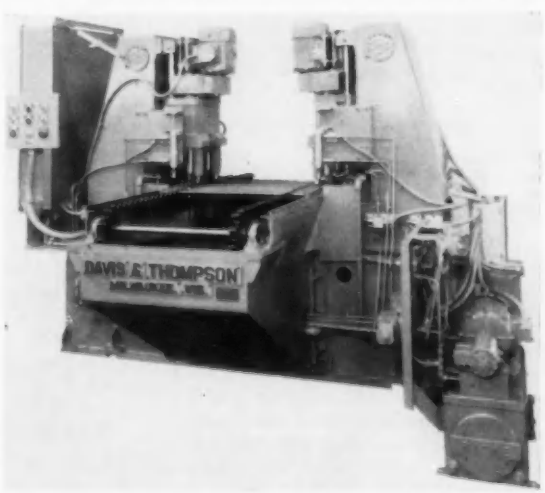
THIS general purpose heavy duty press type spot welder, introduced by the Federal Machine and Welder Co., embodies a special frictionless air head and slide unit. It has an 8 in. diameter, 3 in. stroke operating cylinder, 18 in. throat depth, 100 kva welding transformer with 8 steps of heat regulator plus series-parallel connection. The transformer and heat regulator are an integral unit. Controls are built into the one-piece welded steel frame and upper arm.

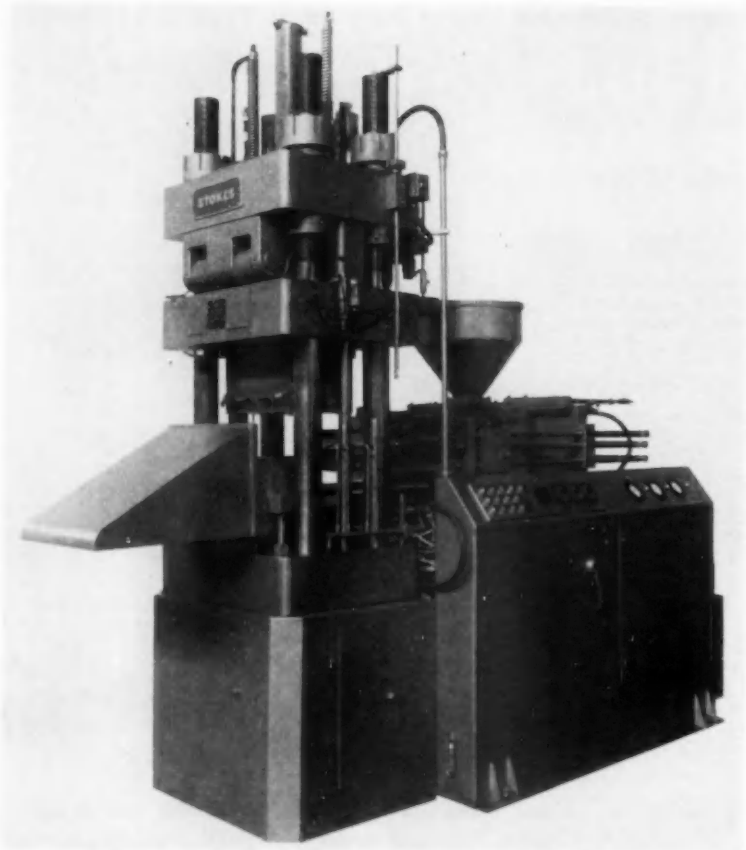
Circle 67 on postcard for more data

Automatic Transfer Unit Chamfers Rear Axle Tie Rods

Pictured is a Roto-Matic Transfer Machine designed for chamfering both sides of both ends of rear axle tie rod. However, the machine is adaptable to a wide range of operations. First station is a probing station provided to insure holes being drilled through before reaching the first chamfering station. The second and third stations are chamfering stations performing their operations on opposite ends of the workpiece. The machine, weighing 6600 lb, will produce 666 parts per hour. (Davis & Thompson Co.)

Circle 68 on postcard for more data





F. J. Stokes Model 703 six ounce automatic injection molding machine

Six Ounce Automatic Injection Molding Machine

THIS Stokes machine, Model 703, in the six ounce range, can be used for producing larger parts, such as automobile taillights and similar pieces. The unit features vertical clamping with horizontal combing. All thermoplastic materials can be handled and the machine gives good performance with nylon.

The injection plunger can be retracted instantaneously, even before the gates are fully set up. This reduces plunger dwell time to a few seconds, and results in shorter overall cycles and greater output per cavity, thus larger total production rates. Cycle time of the Model 703 is eight seconds from mold opening to the start of fill. *F. J. Stokes Corp.*

Circle 69 on postcard for more data

Feed Rate Override

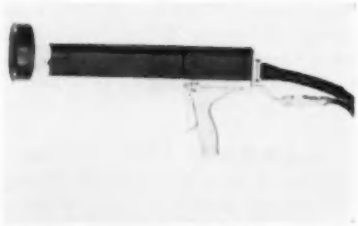
MANUAL feed rate override that permits the operator of numerically controlled machine tools to vary cutter feed rate from that programmed on the control tape is available as a standard feature of the Bendix numerical control systems.

This feature eliminates the necessity of remaking machine control tapes to provide reduced tool loading in critical areas where variables such as cutter quality, material hardness, vibration from fixture or tool or incorrect feed rate programming cannot be taken into account. Feed rate override may be used at any time during the machining cycle without affecting the accuracy of the finished part. *Industrial Controls Section, Bendix Aviation Corp.*

Circle 70 on postcard for more data

Electrostatic Hand Gun

RANSBURG Electro-Coating Corp. has designed an electrostatic hand spray gun. The gun consists of a No. 2 Process atomizing bell incorporated into a lightweight unit designed for manual operation. A special voltage pack is connected with a flexible cable to the gun, creating an electrostatic field between the atomizing bell and the article to be coated. The article must be electrically grounded. Coating material is supplied to the atomizer by either



Ransburg electrostatic hand spray gun

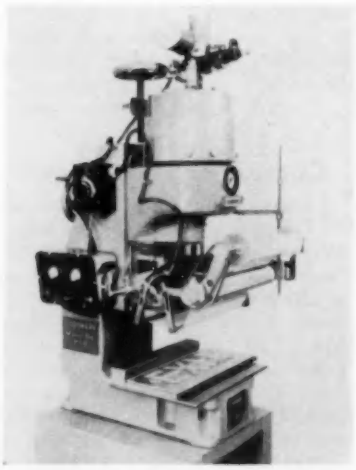
pump unit or pressure tank. Rotation of the bell feeds the liquid to its outer edge and atomization occurs under the influence of the electrostatic field, producing a spray of electrically charged particles.

Circle 71 on postcard for more data

Hot Stamping Head

A HOT-STAMPING head has been designed and is being offered by the Acromark Co. to extend the capacity of the Model 250H Acroleaf Press. This head provides an increased stamping area of up to 12 in. in length by 2½ in. in width. A scrap roll leaf rewind is provided to keep the work area clear and to eliminate down time taken up to chop used foil.

Circle 72 on postcard for more data



Acromark hot stamping for the Model 250H Acroleaf Press

Gearshift Drives

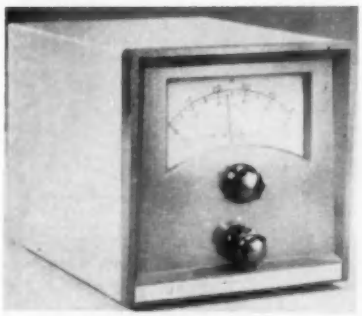
LIMA gearshift drives, designed for many types of industrial applications, are now available in a number of types and gear ratios for vertical mountings (shaft up).

Used with geared devices or V-belts and sheaves to step or reduce the rpm output required to drive machines or perform machine operations, vertically mounted Lima drives are used on drilling, tapping and other metal working equipment, on materials handling equipment, and on various types of specialized equipment. *The Lima Electric Motor Co., Inc.*

Circle 73 on postcard for more data

Overspeed Control

THIS overspeed control is designed for monitoring standard gasoline engines under test without requiring engine alteration. When a limit point is reached the control either shuts down the engine or sounds an alarm. Engines of either six or eight cylinders may be monitored, with ignition systems of six or twelve volts. *Assembly Products, Inc.*



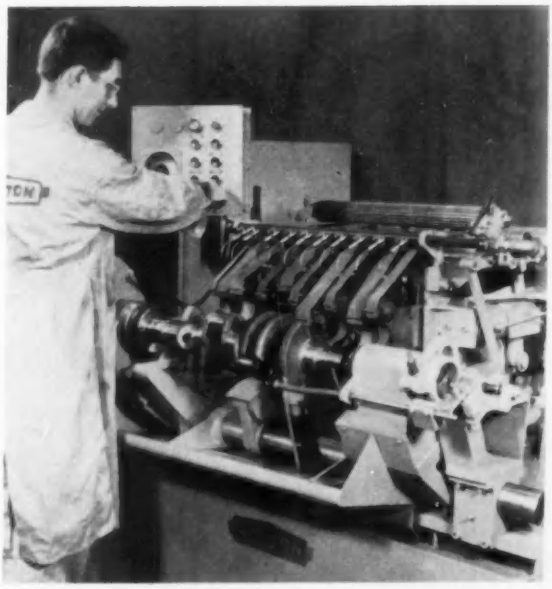
Assembly overspeed control

Circle 74 on postcard for more data

Portable Automatic Feed

COMPACT size, self-contained drive, and simple installation are featured in the new Feedall high-speed parts feeder. The automatic machine, named Model 2200-C, feeds sliding parts ⅛ to 1 in. in diameter, from ½ to 3 in. long, rolling parts ⅜ to 3 in. in diameter, and ⅛ to 1 in. in thickness. It has a 6 cu-ft hopper and 6 in. belt width, combining flexibility for different part sizes and adequate capacity for volume production. Overall size is 94 in. high by 30 by 56 in. on the floor. *Feedall Inc.*

Circle 75 on postcard for more data



Norton No. 31 Crank-O-Lap crankshaft lapping machine. Machine actions occur through the use of a few hydraulic mechanisms, all of which are on the outside of the machine where they offer instant accessibility. Timing-belt drive provides a smooth, positive work rotation which benefits lapping.

Crankshaft Lapping Machine Produces Fine Finishes

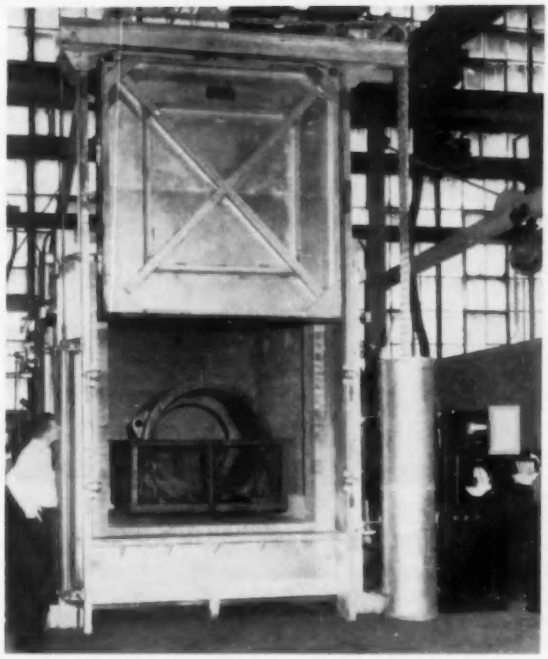
THIS crankshaft lapping machine produces fine surface finishes by means of coated abrasive strips.

The No. 31 Crank-O-Lap machine is designed for low-cost production of fine surfaces on external diameters of automotive type crankshafts. It laps pins and bearings simultaneously in an automatic cycle to low micro-inch readings for improvement of crankshaft service life.

Although developed to finish crankshafts, the machine is also suited to improving the finish of other types of parts. *Norton Co.*

Circle 76 on postcard for more data

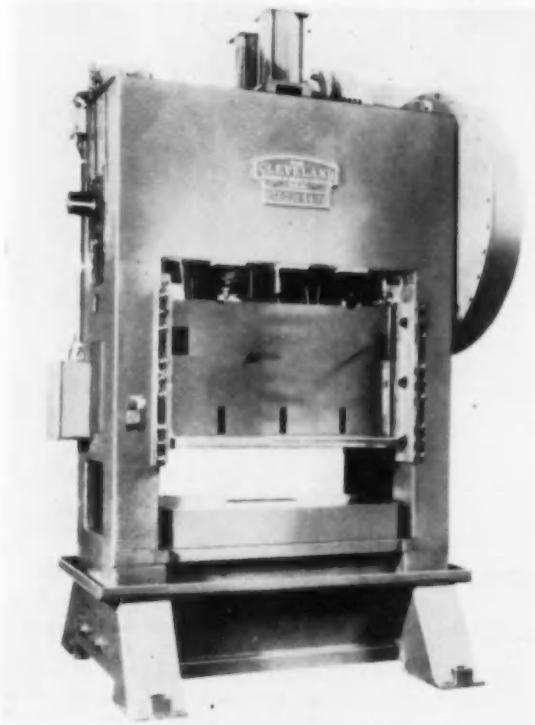
Large Heat Treat Furnace Adds Process Flexibility



This large oven furnace eliminates production problems by performing many different heat treat cycles and accommodating a variety of part sizes to be heat treated. Operating range of the furnace is 600 to 2000 F. Large weldments, forgings, castings and shafts 63 in. long handled in an upright position are easily processed in this unit, which heat treats 7500 lb work loads. (Surface Combustion Corp.)

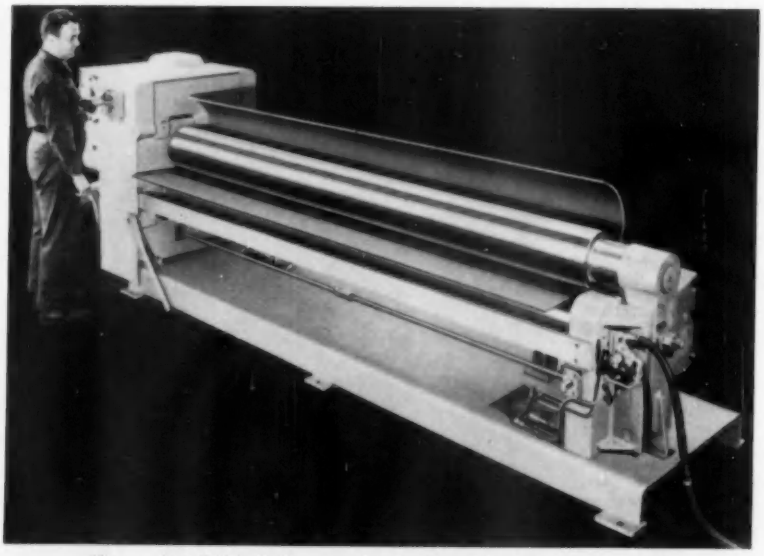
Circle 77 on postcard for more data

Double Eccentric Press Has Capacity Of 200 Tons



High-speed, uninterrupted production is made possible with this double eccentric press having a capacity of 200 tons. Operating at a speed of 50 to 150 spm, the press has a bed area of 36 by 54 in., a 4-in. stroke of slide with a 2-in. adjustment. The distance from bed to slide with stroke down and adjustment up is 20 in. It has single-end drive and is equipped with a drum type friction clutch, electrically controlled and spring-loaded brake. All gears and drive mechanisms are completely enclosed and an auxiliary air brake is included on the flywheel to insure a quick stop. (The Cleveland Punch & Shear Works Co.)

Circle 73 on postcard for more data



Niagara 9 and 10-inch diameter plate bending rolls stress instant control

Plate Bending Rolls With Instant, Fingertip Control

FINGERTIP controls afford ease of operation to the 9- and 10-in. diameter plate bending rolls introduced by Niagara Machine & Tool Works. Designed to turn out commercially true cylinders, these machines handle metal plate up to ¾ in. thick.

Complete, instant control over forward and reverse rotation of rolls is obtained by a squirrel cage brake type motor, momentary contact pushbuttons and oversize magnetic contactors. Rolls deliver full torque the instant buttons are pressed. A powerful brake stops the rolls instantly on release of either button, prevents drifting, and provides control for inching. Other pushbuttons control the raising and lowering of the power adjusted rear roll for quick, easy positioning to the desired cylinder diameter.

Circle 79 on postcard for more data

Dry Hydrogen Furnace

THIS giant dry hydrogen furnace permits vertical brazing of assemblies up to 10 ft long and up to 6 ft in diameter. The instrument con-

Wall Colmonoy dry hydrogen furnace

trolled unit is available for controlled atmosphere brazing, heat treating and annealing. It can be used with pure dry hydrogen, argon, carbon dioxide, nitrogen or exothermic atmospheres. Usable working height is 120 in. and the furnace can accept parts up to 72 in. in diameter. Maximum operating temperature is 2250 F; control of temperature over the entire 10 ft height is accurate within plus or minus 25 F. *Wall Colmonoy Corp.*

Circle 80 on postcard for more data

Electric Lift Truck

THE Yale & Towne Mfg. Co. has designed a 5000 lb capacity lift truck to be added to its 3000 and 4000 lb models in the K51W line of electric lift trucks. The truck is capable of operation in aisles less than 10 ft in width. Lifting speeds are 45 to 50 fpm unloaded and 25 to 30 fpm under load. Unloaded travel speed is 6 to 6½ mph, loaded is 5½ to 6 mph.

Circle 81 on postcard for more data

AIR BRIEFS

By David A. Partridge

Nuclear Bomb Testing Finished

Now that the United States has put into effect a tentative suspension of nuclear explosions, work at the atomic testing site is being shifted to two new products — "Rover" and "Pluto." These deal with the development of nuclear-power propulsion for rockets and ram-jet aircraft. Bomb testing ended on October 30th as a preliminary to the opening of the International Conference at Geneva, Switzerland, on nuclear disarmament.

Meteorological Sounding Rocket

ARCAS, the low-price meteorological sounding rocket was announced at the initial National Conference on High Atmosphere conducted at Texas Western College by the El Paso branch of the American Meteorological Society in conjunction with the New Mexico-West Texas section of the American Rocket Society.

ARCAS is a solid propellant vehicle being developed by Atlantic Research Corp. as a low-price weather study research rocket which is expected to provide a practical unit for use in atmospheric research programs at universities and colleges.

In flight, the ARCAS power plant burns out after 26 seconds when the rocket has reached 40,000 ft and a maximum speed of 3500 fps. The rocket then coasts to peak altitude, which it reaches approximately 100 seconds after launching.

In quantity production, the price tag for the ARCAS is expected to read around $500 a round, not including the instrument package. As the unit is designed as a research tool, no standard instrumentation has been designed for it. Several combinations are now under development, all of which will be mounted on a standard base plate for ease of installation.

Brief Air Briefs

Major integrated research program in solid propellants launched in late October by the Advanced Research Projects Agency—Navy and Air Force are looking for a low-cost high-speed missile target —In '57 free world airlines used 55 million barrels of aviation gasoline, by 1961 they will be using some 70 million barrels of turbo fuel in addition to aviation gasoline—Expenditures for research, development and production of civil turbojet and turboprop transports by five aircraft companies amounted to $1.6 billion before the first aircraft was delivered—The United States airlines are expected to spend between now and the end of 1962 about $4,000,000,000 for equipment, including power plants, spare parts, ground equipment and facilities, increased working capital and debt retirement. About $2,-200,000,000 is for equipment—As of January, 1958, there were 67,-153 active aircraft registered with the CAA. This represents a four per cent rise over registrations for 1957 which totaled 64,688 aircraft —In 1957, reports the CAA, general aviation aircraft flew 10.9 million hours and traveled 1400 million miles. By comparison the airlines on scheduled domestic flights flew 3.6 million hours and a total of 785 million miles.

Backlog Of Aircraft Orders

The value of backlog of orders, reported by manufacturers of complete aircraft, aircraft engines, and aircraft propellers as of June, 1958, amounted to $13,722 million, according to the Bureau of the Census and Civil Aeronautics Administration, Department of Commerce. This represents a four per cent decrease from the backlog of $14,324 million reported at the end of March, 1958, and a 16 per cent decrease from orders on hand at the end of the second quarter of 1957.

Shipments of Complete Civilian Aircraft

Shipments of complete civilian aircraft, as measured by airframe weight, amounted to 1,106,500 lb in August, 1958. During that month 471 planes valued at $30.8 million were shipped. Unfilled orders for civilian planes of 3000 lb airframe weight and over amounted to 693 at the end of August, 14 per cent under the backlog one year ago.

X-15 Manned Research Airplane Rolled Out

The X-15 manned research airplane, designed to fly "out of the earth's atmosphere" was rolled out of the North American Aviation Hangar October 15. It is expected to fly to a height of approximately 100 miles above the earth and at speeds up to 3600 mph. The plane will carry its own atmosphere in a significantly advanced pressurization and air conditioning system for the pilot and vital equipment.

Airways Modernization Board Transferred To Federal Aviation Agency

The President signed, November 1st, an Executive Order which transfers all functions of the Airways Modernization Board to the newly appointed administrator of the Federal Aviation Agency, Mr. Elwood R. Cuesada. This action is

(*Turn to page* 84, *please*)

The BUSINESS PULSE

Recovery Accelerating as Production of Nondurable Goods Moves Toward an All-Time High. Durable Goods Industries, with a Few Exceptions, Show Gains. Trend of Personal Income Still Upward

This Survey, published for the readers of automotive magazines exclusively in AUTOMOTIVE INDUSTRIES, has been prepared by the Guaranty Trust Company of New York

All things considered, the recovery movement seems to have gathered additional momentum this autumn. Although industrial production has not advanced as rapidly as in earlier months, this is not particularly surprising, if allowance is made for the crippling local work stoppages that have plagued the automobile industry, which is normally the star performer in the economy at this time of year.

Actually, the showing of industrial production, other than automotive, has been highly gratifying. The output of minerals has registered further substantial gains, and the production of nondurable goods has moved ahead into new all-time high ground. And except for the weakness in automobile activity, durable-goods industries have continued to show broadly diffused gains. Steel output, the prime bellwether of durable-goods activity, has moved ahead smartly, with production of ingots in October apparently some 50 per cent above April's recession low, seasonally adjusted.

Running counter to the recovery movement was a moderate relapse in retail sales during September on a seasonally adjusted basis. This, like the slower rate of gain in industrial production, gave rise to some concern lest the upturn might be stalling. An extension of such a trend would certainly be worrisome, but one month's unfavorable experience is probably not too significant, particularly since this is an area in which month-to-month changes have often been erratic in the past.

Personal Income Rises

The really important consideration, for the time being, is that the trend of personal income, which provides the wherewithal for retail purchases, is still upward. It is noteworthy, moreover, that spokesmen for retailer groups in assessing the outlook for the Christmas season have been quite optimistic. And the new survey of consumers' buying plans, financed by *Newsweek* and conducted by the National Industrial Conference Board, indicates that consumers are in a much more cheerful frame of mind than six months ago.

The automobile situation has, of course, been a special drag on retail trade volume this autumn, but presumably this is only temporary. Dealers have clearly been inadequately stocked, both with old models and with new. Such reports as are available on public interest in Detroit's new offerings are very favorable, on the whole, but it is too early to be certain what the ultimate performance will be. However, the common assumption that 1959 models will sell better, and probably much better, than their 1958 counterparts still looks very reasonable.

Over-all retail sales, it should be noted, tend to be a "lagging" indicator. In the latter part of 1954, for example, they were somewhat tardy in confirming the general recovery movement. At that time, the really dramatic upturn came only with keen consumer interest in new automobiles at the very end of the year.

Labor-Market Developments

That the recovery has not bogged down this autumn is attested by labor-market developments. September brought the first real improvement in unemployment since the beginning of general recovery, as the jobless total for the month declined by some 600,000 to 4.1 million. This was a much larger drop than is usual for the time of year, and it negated to some extent earlier fears that an unusually "sticky" unemployment situation would persist for some months.

It looks as if October data, when available, will show further reduction in the jobless total. After that, there is likely to be a seasonal rise in unemployment until February, but a climb back to the 5-million mark (so freely predicted by spokesmen for organized labor) now begins to look improbable.

Actually, on a seasonally-adjusted basis there is every prospect of further improvement in the unemployment situation through the winter, probably at a more rapid pace than any rise in general business. Until recently, there was a tendency for employer to lengthen the work week of those already on payrolls rather than take on new workers. However, much of the slack has now been eliminated from the average work week, which means that there will have to be more emphasis on rehiring to accommodate production advances from this point on.

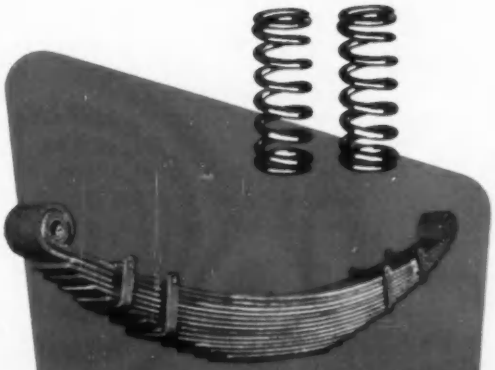
Bank Loans Rise

Besides the foregoing, there are

(*Turn to page* 84, *please*)

What to do when the BUBBLE BREAKS

Trucks, buses, trailers, tractors, off highway equipment, and private motor cars of almost every prominent make use Burton Leaf or Coil springs as original equipment.



When you want reliability ...dependability...specify Steel Springs. Come to Burton to get them!

It all looks very pretty . . . then POW . . . those plans that looked so good on paper turn out worse than worthless when they're on the road. That's why correct engineering is so important in the automotive industry.

For many years, Burton Spring engineers have made a specialty of translating engineering ideas into the sound reality of tempered steel. Steel Springs not only offer a time-tested way to absorb road shocks, but they possess inherent structural qualities that make for stability and endurance in the entire vehicle. They not only soften and control vertical motion, but efficiently control lateral and longitudinal "play," side sway and rocking.

BURTON AUTO SPRING CORP.

. . . Vital Support for the Automotive Industry . . .

WESTERN AVENUE AT FORTY-EIGHTH STREET • CHICAGO 32, ILLINOIS

More Government Contract Awards

LATEST contracts awarded by various Government agencies, and covering primarily automotive and aviation products, are listed in the following. Typical of the items contained in these monthly listings are: passenger cars, motor trucks, aircraft, military tanks, engines, transmissions, other components, spare parts, plant equipment, etc. This list is for the period October 1 to October 30, inclusive.

NUCLEAR PRODUCTS, ERCO, ACF INDUSTRIES, INC., Riverdale, Md.
Flight simulators, spares, related data —$1,619,658

AMERICAN BOSCH ARMA. CORP., Garden City, N. Y.
Spare parts, fire control systems—$90-171

AUTOMATIC TRANSPORTATION CO. DIV., YALE & TOWNE MFG. CO., Chicago, Ill.
Truck, fork-lift, maintenance technical data—37 ea—$184,613

AVCO MANUFACTURING CORP., Cincinnati, Ohio
Spare parts, various aircraft—$129,915

AVCO MFG. CORP., CROSLEY DIV., Cincinnati, Ohio
Spare parts—$28,955

AVCO MANUFACTURING CORP., LYCOMING DIV., Williamsport, Pa.
Reciprocating aircraft engines—$1,088,-065

BARDEN CORP., Danbury, Conn.
Annular ball bearing, aircraft—20,000 ea —$133,680
—$133,680

BENDIX AVIATION CO., BENDIX PRODUCTS DIV., South Bend, Ind.
Forged main wheel assy—$600,000

BENDIX AVIATION CORP., BENDIX PRODUCTS DIV., South Bend, Ind.
Spare parts applicable to various aircraft—$85,826

BENDIX AVIATION CORP., BENDIX WEST COAST DIV., Burbank, Calif.
Spare parts, C-121 aircraft—$25,301

BOEING AIRPLANE CO., Seattle, Wash.
Airplane, spare parts, data—$53,250,000

CATERPILLAR TRACTOR CO., Peoria, Ill.
Engine assembly—10 ea—$41,645

CHRYSLER MOTORS CORP., Washington, D. C.
Trucks—14 ea—$48,248

CONSOLIDATED DIESEL ELECTRIC CORP., Stamford, Conn.
Sweeper, magnetic, road—20 ea—$136,-316

COVEL MANUFACTURING CO., Benton Harbor, Mich.
Grinder, surface—$291,500

DOUGLAS AIRCRAFT CO., INC., Santa Monica, Calif.
Facilities, ballistic missile—$475,000

DOUGLAS AIRCRAFT CO., INC., Charlotte, N. C.
Nike spare parts & components—$139,-510

FIRE MASTER CORP., Mt. Clemens, Mich.
Truck, fire fighting—56 ea—$282,575

FORD MOTOR CO. OF CANADA, LTD., East Toronto, Ontario, Canada
Automobiles—11 ea—$16,489

FORD MOTOR CO. OF CANADA, OVERSEAS DIV., East Toronto, Ontario, Canada
Automobiles—17 ea—$27,530

FORD MOTOR CO., FORD DIV., Washington, D. C.
Automobiles—46 ea—$249,199

FORD MOTOR CO., FORD DIV., Washington, D. C.
Trucks—32 ea—$124,006

GENERAL ELECTRIC CO., SMALL AIRCRAFT ENGINE DEP'T, West Lynn, Mass.
T58-GE-6 engines—$1,250,000

GENERAL MILLS, INC., Minneapolis, Minn.
Spare parts, aircraft—$196,528

GENERAL MOTORS CORP., ALLISON DIV., Indianapolis, Ind.
T56-A-7 turbo prop engines—$1,952,040

GENERAL MOTORS CORP., DETROIT DIESEL ENGINE DIV., Wayne, Mich.
Repair parts, diesel engines—9990 ea—$21,890

GMC, NEW DEPARTURE DIV., Bristol, Conn.
Annular ball bearing—11,449 ea—$57,663

GMC, TRUCK & COACH DIV., East Pontiac, Mich.
Spare parts, automotive—$32,604

GENERAL TIRE & RUBBER CO., Akron, Ohio
Nose wheel assys, various aircraft—$88,428

B. F. GOODRICH CO., AVIATION PRODUCTS DIV., Akron, Ohio
Landing wheel and brake assys, various aircraft—$235,643

B. F. GOODRICH CO., AVIATION PRODUCTS, DIV., Akron, Ohio
Wheel assys—$86,465

B. F. GOODRICH CO., AVIATION PRODUCTS DIV., Dayton, Ohio
Wheels and brakes, aircraft—$227,610

GOODYEAR TIRE & RUBBER CO., Akron, Ohio
Nose wheel assys—$121,102

GOODYEAR TIRE & RUBBER CO., Akron, Ohio
Spare parts, B-57 aircraft—$141,926

HEIL CO., Milwaukee, Wis.
Truck, tank, aircraft refueler—$5,847,-604

HOLLEY CARBURETOR CO., Warren, Mich.
Fuel controls—102 ea—$288,067

INTERNATIONAL HARVESTER CO., Washington, D. C.
Trucks—9 ea—$32,312

M. L. MAXSON CORP., New York, N. Y.
Spare parts, B-57 aircraft—$37,263

MICROMATIC HONE CORP., Detroit, Mich.
Machine, honing—$58,936

MINNEAPOLIS - HONEYWELL REGULATOR CO., Philadelphia, Pa.
Nike—corporal spare parts, replenishment—$10,571

MOBILE DRILLING INC., Indianapolis, Ind.
Truck, mobile drilling unit—1 ea—$15,-341

MOHAWK RUBBER CO., Akron, Ohio
Tire—11,289 ea—$17,367

NORTH AMERICAN AVIATION, INC., Los Angeles, Calif.
Spare parts, various aircraft—$2,056,039

NORTHROP AIRCRAFT, INC., NORTHROP DIV., Hawthorne, Calif.
Missiles, spare parts, handbooks—$20,-000,000

PRATT & WHITNEY CO., INC., West Hartford, Conn.
Machine, milling, installation drawings —$109,608

RAYTHEON MFG. CO., Andover, Mass.
Repair parts, missile—$497,933

SERVOMECHANISMS, INC., Hawthorne, Calif.
Spare parts, aircraft—$92,061

U. S. AIR CONDITIONING CORP., HUGHES-KEENAN DIV., Delaware, Ohio
Truck, spare parts—4 ea—$44,329

WEST BEND ALUMINUM CO., West Bend, Wis.
Motor, outboard with chest—925 ea—$536,319

WESTERN ELECTRIC CO., INC., New York, N. Y.
Nike spare parts & components—$645,-163

WILLYS MOTORS INC., Toledo, Ohio
Trucks—24 ea—$50,344

AIRBRIEFS

(*Continued from page* 81)

in accordance with the Federal Aviation Act of 1958 which authorized the President to transfer to the Administrator of the Federal Aviaton Agency "any functions of the Executive Departments or agencies of the Government or any officer or organizational entity thereof" which are related to establishing, operating and maintaining systems and facilities, for safe and efficient air navigation and air traffic control.

1100 F Titanium Alloy

Mallory-Sharon Metals Corp. has announced development of a titanium alloy capable of withstanding temperatures of 1100 F for long periods of time and temperatures of 1500 F for short durations. The new alloy, named MST 881, was under development for three years under the project name of Alloy X. Its final designation was determined from the percentage of its alloying elements—eight per cent aluminum, eight per cent zirconium and one per cent tantalum and columbium combined.

MST 881 is intended for use in the construction of Mach 3 jet engines, manned aircraft, and missiles and is available in bars, billets and forging stock. ■

BUSINESS PULSE

(*Continued from page* 82)

other signs that the recovery movement has broadened this autumn. Bank loans to business outside the New York City financial center have risen considerably. Construction activity has also been a prominent factor of strength, with foreshadowing data indicating that vigor will persist for some time. A majority of the eight so-called leading indicators still point upward. Freight carloadings, which reflect a broad range of activities in the economy, have been running at impressive levels. Productivity appears to be rising rapidly, greatly enhancing fourth-quarter profit prospects. ■

• • INDUSTRY STATISTICS • •

WEEKLY U. S. MOTOR VEHICLE PRODUCTION

As reported by the Automobile Manufacturers Association

Make	Weeks Ending Nov. 1	Weeks Ending Oct. 25	Year to Date 1958	Year to Date 1957
PASSENGER CAR PRODUCTION				
Rambler	7,493	6,499	158,344	87,710
Total—American Motors	7,493	6,499	158,344	87,710
Chrysler	1,401	1,043	40,868	103,403
De Soto	1,504	910	29,725	104,238
Dodge	4,480	4,051	93,896	254,144
Imperial	258	382	10,042	33,126
Plymouth	11,391	11,074	305,781	566,657
Total—Chrysler Corp.	19,034	17,460	480,312	1,061,570
Edsel	1,373	1,539	13,470	50,387
Ford	31,293	27,782	769,255	1,261,952
Lincoln	557	431	19,489	31,288
Mercury	2,385	1,636	89,342	237,741
Total—Ford Motor Company	35,608	31,388	891,556	1,581,368
Buick	7,175	4,448	175,330	324,629
Cadillac	1,054		94,280	126,668
Chevrolet	17,624	3,494	931,429	1,202,169
Oldsmobile	5,131	4,102	227,995	313,120
Pontiac	4,019	1,433	151,116	275,252
Total—General Motors Corp.	35,003	13,477	1,580,150	2,241,838
Packard			1,723	4,682
Studebaker	2,724	2,104	30,989	57,709
Total—Studebaker-Packard Corp.	2,724	2,104	32,712	62,391
Checker Cab	85	72	2,395	3,413
Total—Passenger Cars	99,947	71,000	3,145,469	5,038,290
TRUCK AND BUS PRODUCTION				
Chevrolet	6,645	1,677	206,834	290,781
G. M. C.	1,113	993	47,323	57,062
Diamond T	158	147	4,737	4,777
Divco	70	70	2,422	2,499
Dodge and Fargo	1,439	1,159	45,541	65,512
Ford	7,361	7,312	196,023	289,623
F. W. D.	18	29	1,060	934
International	156	2,017	76,077	101,657
Mack	279		11,798	14,559
Studebaker	244	220	8,294	11,865
White	426	413	14,203	16,203
Willys	2,172	2,212	73,877	63,039
Other Trucks	55	55	2,425	3,568
Total—Trucks	20,133	16,304	680,614	922,079
Buses	25	50	2,632	3,405
Total—Motor Vehicles	120,105	87,354	3,828,715	5,963,774

RETAIL CAR SALES BY PRICE GROUPS*

NUMBER OF CARS

1958

Price Group	July Units†	July % of Total	August Units†	August % of Total
Under $2,000	5,531	1.48	5,168	1.52
$2,001 to $2,500	249,723	67.00	231,582	67.91
$2,501 to $3,500	86,233	23.13	76,841	22.53
Over $3,500	31,283	8.39	27,417	8.04
Total	372,770	100.00	341,008	100.00

Eight Months

Price Group	1958 Units†	1958 % of Total	1957 Units†	1957 % of Total
Under $2,000	32,425	1.11	21,187	.53
$2,001 to $2,500	1,896,345	64.78	2,513,943	63.03
$2,501 to $3,500	723,132	24.70	1,131,188	28.36
Over $3,500	275,599	9.41	322,232	8.08
Total	2,927,501	100.00	3,988,550	100.00

DOLLAR VOLUME OF SALES

1958

Price Group	July Dollars	July % of Total	August Dollars	August % of Total
Under $2,000	$ 9,887,034	1.01	$ 9,221,400	1.03
$2,001 to $2,500	584,461,035	59.68	541,682,045	60.68
$2,501 to $3,500	247,629,565	25.29	220,726,622	24.73
Over $3,500	137,252,639	14.02	121,024,250	13.56
Total	$979,230,273	100.00	$892,654,317	100.00

Eight Months

Price Group	1958 Dollars	1958 % of Total	1957 Dollars	1957 % of Total
Under $2,000	$ 57,731,528	.74	$ 38,345,893	.37
$2,001 to $2,500	4,436,685,947	57.10	5,648,962,479	54.10
$2,501 to $3,500	2,053,401,306	26.43	3,194,327,415	30.59
Over $3,500	1,222,395,867	15.73	1,559,582,697	14.94
Total	$7,770,214,648	100.00	$10,441,218,484	100.00

*—Calculated on basis of new car registrations, as reported by R. L. Polk & Co., in conjunction with advertised delivered price at factory of four door sedan or equivalent model. Does not include transportation charges or extra equipment.

†—New registrations of American made cars only. Does not include imported foreign cars.

REGISTRATIONS OF FOREIGN CARS

*First Nine Months**

1958		1957	
Volkswagen	57,738	Volkswagen	46,209
Renault	31,390	Renault	15,654
English Ford	22,917	English Ford	11,392
Fiat	14,157	M. G.	10,504
Hillman	12,599	Metropolitan	9,170
All Others	124,022	All Others	51,960
Total	262,823	Total	144,909

* Does not include returns for Oregon for July, August or September.

1958 NEW REGISTRATIONS

Based on Data from R. L. Polk & Co.

Arranged in Descending Order According to the Nine Month 1958 Totals

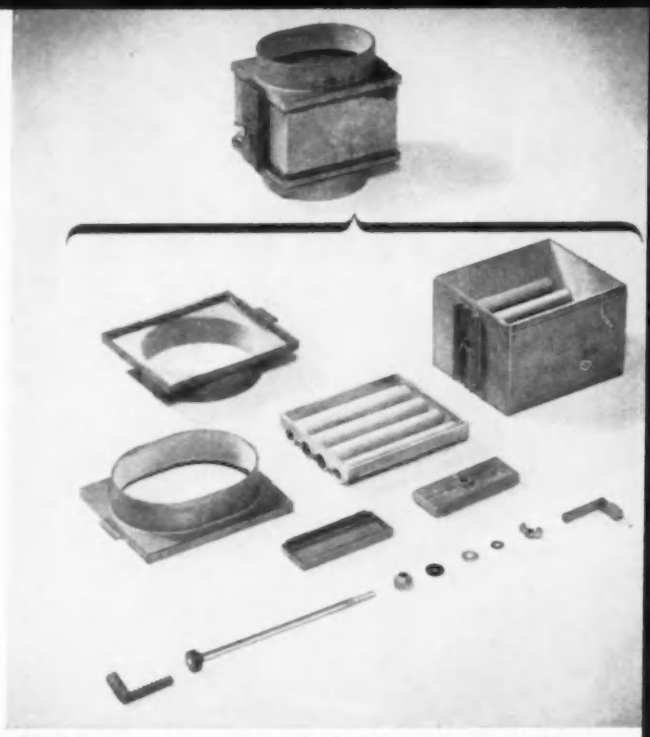
NEW PASSENGER CARS

Make	September 1958	August 1958	September 1957	Nine Months 1958	Nine Months 1957
Chevrolet	86,118	106,452	123,181	969,128	1,098,773
Ford	67,996	82,682	121,154	737,285	1,145,985
Plymouth	29,118	33,909	49,857	300,761	480,176
Oldsmobile	16,695	21,566	29,827	231,692	286,697
Buick	16,297	14,328	28,323	190,240	307,718
Pontiac	13,705	16,445	25,823	170,353	249,819
Rambler	11,208	15,630	4,973	123,351	66,102
Mercury	10,065	11,972	21,803	105,635	212,872
Dodge	9,631	10,628	21,183	100,546	204,896
Cadillac	7,762	9,817	11,931	95,998	108,179
Chrysler	4,287	4,631	8,934	46,626	83,302
De Soto	3,402	3,588	7,901	37,347	81,536
Studebaker	2,864	3,047	4,551	30,311	48,254
Edsel	1,929	2,147	7,566	28,744	7,566
Lincoln	1,665	1,605	2,800	20,515	27,909
Imperial	886	942	2,611	11,407	26,312
Metropolitan	1,131	1,196	1,381	9,243	9,170
Packard	189	187	352	2,276	4,531
Misc. Domestic	144	409	1,360	2,434	15,659
Foreign	36,015	33,999	19,726	255,960	135,739
Total—All Makes	321,108	375,180	495,217	3,489,872	4,601,195

NEW TRUCKS

Make	September 1958	August 1958	September 1957	Nine Months 1958	Nine Months 1957
Chevrolet	19,416	23,709	27,380	188,848	228,354
Ford	18,116	18,383	25,524	153,009	211,117
International	8,073	7,437	9,213	66,090	72,446
G. M. C.	5,218	5,276	5,275	40,886	47,955
Dodge	2,672	2,980	4,173	27,804	36,515
Willys Truck	1,255	1,021	1,166	9,395	11,167
Mack	1,131	885	1,072	8,827	10,067
White	961	913	1,041	8,807	11,678
Willys Jeep	817	656	555	4,941	4,793
Studebaker	298	311	461	3,257	5,296
Diamond T	226	261	240	2,163	2,572
Divco	167	140	169	1,616	2,033
Brockway	106	70	58	646	521
Kenworth	117	95	149	629	840
Peterbilt	36	28	37	310	398
F. W. D.	22	26	26	286	353
Misc. Domestic	89	85	78	661	647
Foreign	2,970	2,668	1,537	19,935	10,386
Total—All Makes	61,690	64,924	78,156	538,110	657,138

D-J casts, finish machines, plates and assembles door hardware for a Mid-West merchandiser. Eleven zinc parts are die cast . . . then tapped, reamed, faced and plated. Other parts are drawn and stamped as needed. Springs, lock washers, screws, locks and keys are purchased. Finally, D-J assembles and packages the units.

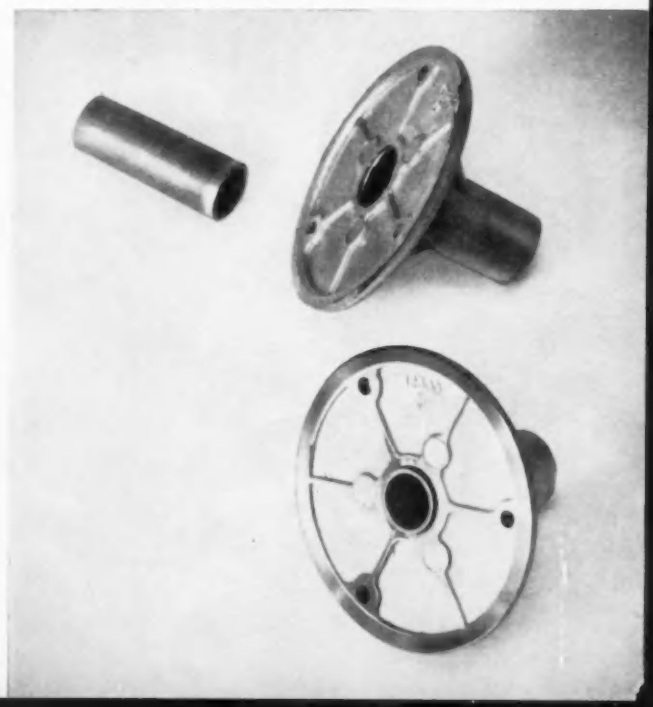


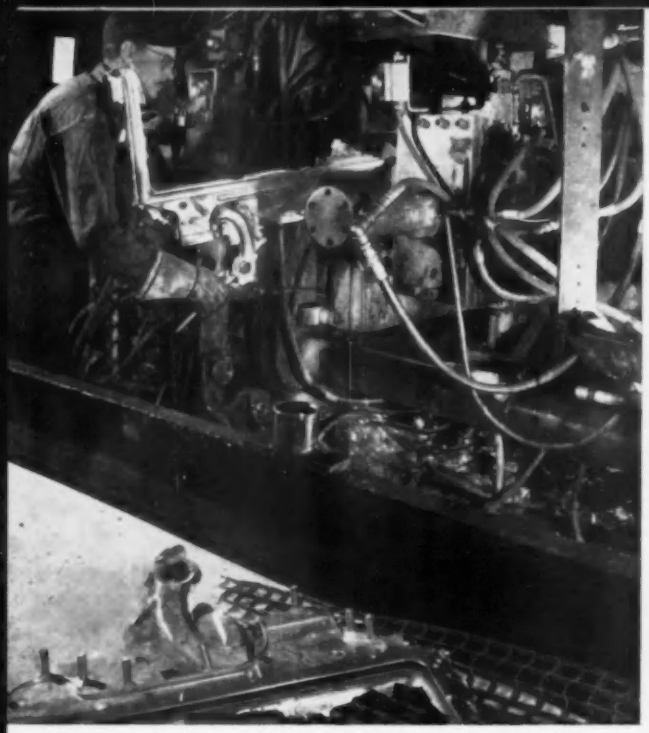
D-J die casts, machines, flock finishes and assembles damper for York Corporation. Unit is a complex high precision assembly of ten die cast parts including racks, pinions, and pistons. D-J flocks interior parts before assembly, seals seams to air-tightness under pressure. Exterior surfaces are carefully alodined.

3 pages of proof Doehler-Jarvis can do more for you than die cast parts...

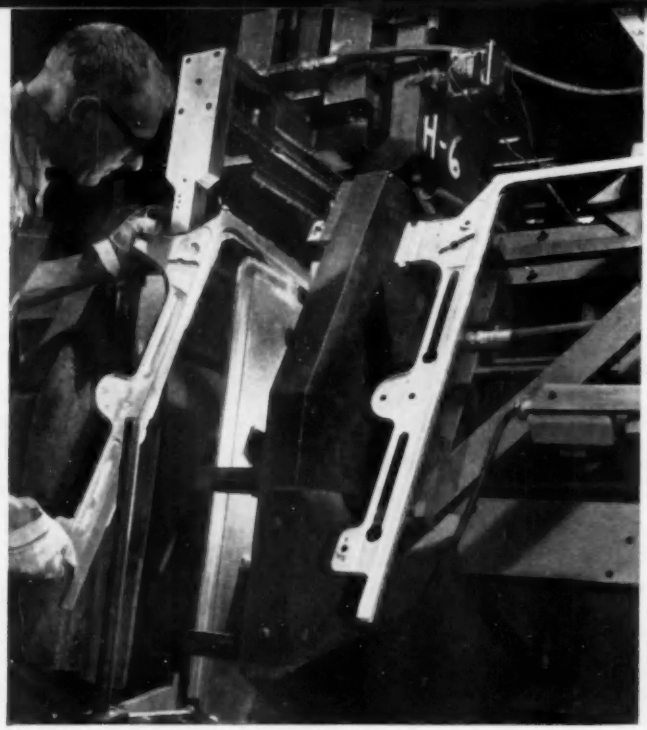
D-J casts, profile shapes, taps and electro-statically paints TV set parts for Radio Corporation of America. Ready-for-assembly die castings are by far the lowest-cost way to produce lightweight metal bezels and glass retainers for RCA Victor TV sets. Their dimensional stability speeds assembly.

D-J casts, machines, and assembles turntable hubs for well-known phonograph manufacturer. Hubs are trimmed, turned, slotted, reamed and fitted with bearings. The bearings are then chamfered and sized. Tolerances of 0.001 inch or less are maintained throughout all these operations.





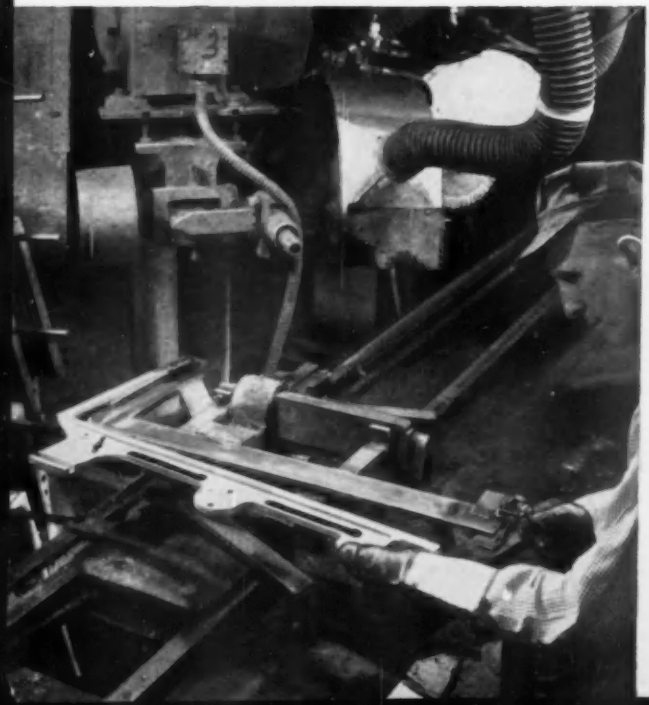
1 **Operator removes die cast zinc main channel** for Lincoln or Continental window assembly from large 48" casting machine. Part is quenched in cooling solution then conveyed to trimming. D-J is now researching production techniques on giant 72" machine, world's largest.



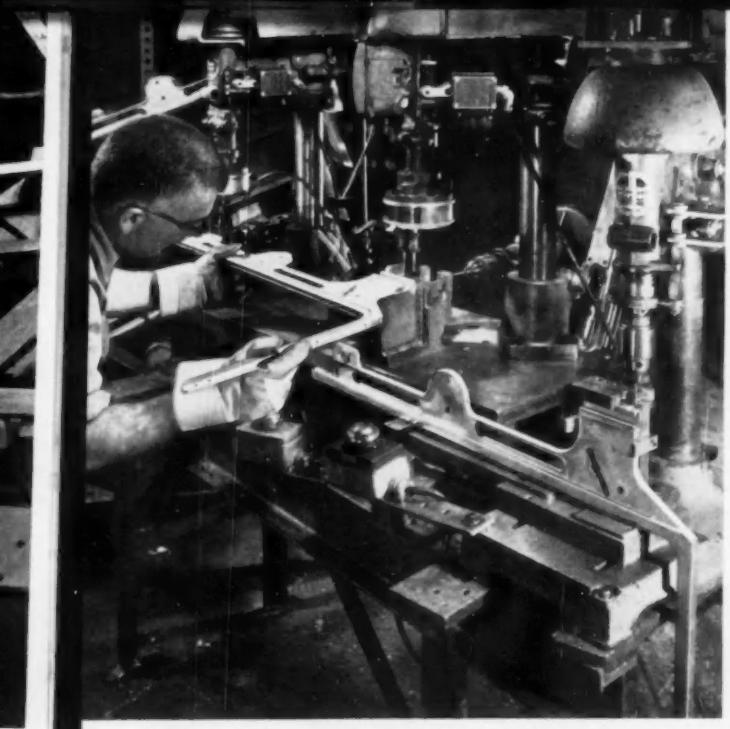
2 **Ingenious double-acting trimmer removes gate,** trims flash, finishes slots, taps 3 holes. Notice jig at right miters corner of frame. Scrap metal is collected, re-melted, re-refined and re-used. Minimum metal consumption is a big advantage of die casting.

...D-J makes machines, plates, puts together

4 **Buffing, too, is set up for maximum economy.** Part is snap-clamped to device that positions it automatically for buffing wheels. When leaving fast-moving buffing lines, parts are racked and processed by conveyor through degreasing into plating without further handling.



5 **"Christmas trees" carry channels through plating.** Part is given optimum copper, nickel, chrome thicknesses using an automatic "plate-on-plate-off" current sequence that develops unusually high quality long-lasting finish desired for this premium car.



3 **Ganged machines complete drilling, tapping, reaming.** Behind operator you can see a universal work toting device. Removable pins support work and present it to operator prepositioned for speediest handling. (For another view of device, see following picture.)

Not everyone knows that Doehler-Jarvis does extensive machining, finishing and sub-assembly work as well as die casting.

But it's true. Every Doehler-Jarvis Plant (8 in the U. S. and Barber Die Casting in Canada) mass produces sub-assemblies, as well as die casting and finishing basic parts. And you can rest assured, costs undercut those that customers might achieve in their own plants.

Costs are bound to be low. Doehler-Jarvis has in abundance versatile machining, metal forming and joining equipment plus finishing facilities that are unique. Experienced design, purchasing and production personnel, too. Everything needed to set up economical, continuous production, assembly, and packaging lines.

a window assembly for the Lincoln Continental

6 **Window is glazed and finish assembled in special jig.** Here die cast channel, glass and other parts (some made, some purchased by D-J) are put together and weather sealed. Packaged part is shipped both to the Lincoln and Continental plants and to distributor warehouses.

There are other savings, too . . . savings in *your* plant. Less tooling, for example. And you receive a responsibly inspected, fully functional sub-assembly ready for immediate use. Many D-J customers take delivery only on sub-assemblies needed for basic production. Spare-part production goes directly to customer's distributors.

Makes sense, doesn't it? Especially when you see, as in these three pages of pictures, how D-J handles typical production work.

Maybe you could push your costs down this way, too. Care to talk it over?

Doehler-Jarvis
DIVISION OF NATIONAL LEAD COMPANY
General Offices: Toledo 1, Ohio

In Canada:
Barber Die Casting Co. Limited
Hamilton, Ontario

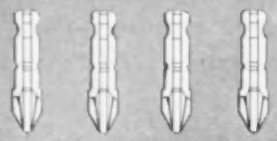
Circle 140 on Inquiry Card for more data

Count on *Continental* for this

2-way saving in bit costs

HY-PRO

You get 4 HY-PRO PHILLIPS Insert Bits



for the cost of 1

conventional bit

HY-PRO PHILLIPS Insert Bits cost only about one-fourth as much as solid bits, and there is no extra expense for re-sharpening. When a HY-PRO bit wears out, you simply replace it with a new bit . . . and restore *full* driving efficiency at negligible cost.

POWER BIT HOLDERS made in types and sizes to fit all driving tools

HY-PRO PHILLIPS Insert Bits are FORGED

Tested and proved to **outlast other bits 2 to 1**

Best comparable bit — HY-PRO Phillips Bit

Each bit drove the same number of screws

High strength *forged* HY-PRO Bits are production tested and proved to have an average service life *double* that of the best comparable bits. Many users report even greater margins of extra life for HY-PRO bits, often as high as 4 to 1.

Make your own tests— Compare bit life on your toughest driving jobs. Figure *all* costs. Continental Assembly Specialists will cooperate fully in conducting tests. You'll find HY-PRO Insert Bits and Holders your best buy for lasting bit economy.

Precision control with the same Phillips master tools assures uniformly accurate fit of HY-PRO Phillips Bits and HOLTITE Phillips Screw recesses. Use this proved combination for the top efficiency you need in assembly — especially with power and automatic driving equipment — to avoid downtime, rejects, and weak fastenings. For full information, write: Continental Screw Co., 451 Mt. Pleasant St., New Bedford, Mass.

Only CONTINENTAL makes BOTH PHILLIPS SCREWS and PHILLIPS BITS

MEMBER SCREW RESEARCH ASSOCIATION

CONTINENTAL

SCREW COMPANY, NEW BEDFORD, MASS.

HOLTITE FASTENERS

HOLTITE PHILLIPS AND SLOTTED HEAD

WOOD • MACHINE • TAPPING
THREAD FORMING •
SEMS • NYLOK

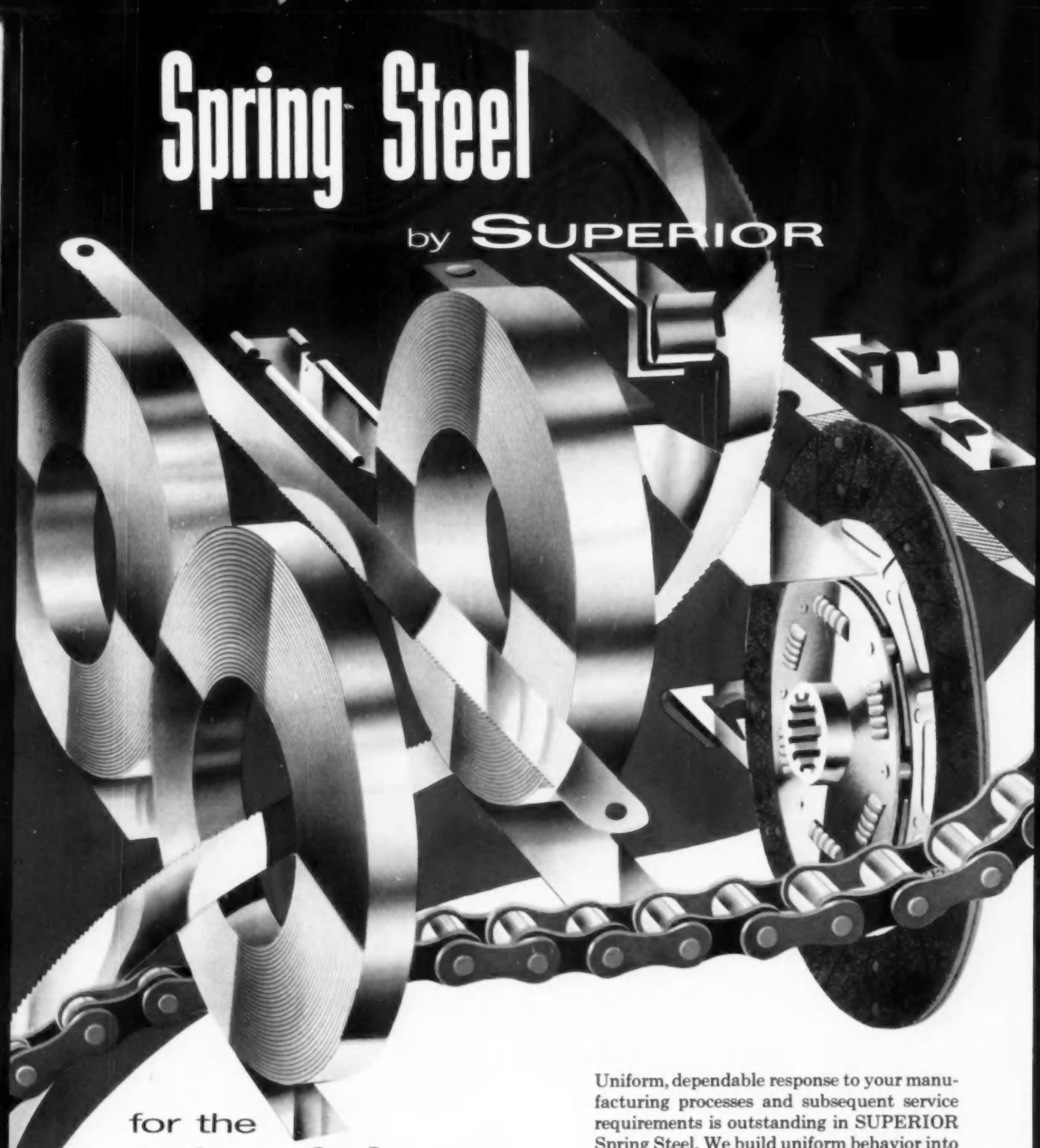
HY-PRO PHILLIPS INSERT BITS AND HOLDERS

HY-PRO TOOL COMPANY. . . DIVISION
RESEARCH ENG. & MFG., INC. SUBSIDIARY

Circle 141 on Inquiry Card for more data

Spring Steel

by SUPERIOR



for the

uniform behavior

you require

in fabrication!

in service!

Uniform, dependable response to your manufacturing processes and subsequent service requirements is outstanding in SUPERIOR Spring Steel. We build uniform behavior into every coil, from specified analysis of composition to final anneal before shipment. We're strip steel specialists: *you gain by it.* Specify SUPERIOR for your spring steel needs!

Superior Steel

DIVISION OF

COPPERWELD STEEL COMPANY

CARNEGIE, PENNSYLVANIA

For Export: Copperweld Steel International Company, New York

THIS MUCH DIRT CAN RUIN A DIESEL ENGINE

THIS PUROLATOR FILTER

STOPPED THIS MUCH DIRT

Diesels can't escape abrasive dirt . . . and it takes about 8 ounces of it to ruin an engine.

The 18 pounds of dirt shown above were stopped by a Purolator heavy duty dry type air filter on a rock drilling rig in 940 hours of operation—with no servicing of the filter required. The 6 cylinder, 2 cycle engine and the 750 CFM compressor used on the job were fully protected through the toughest operating conditions. 18 pounds of dirt were stopped . . . none got through the filter.

There's a Purolator dry type air filter designed to meet the specific requirements of your operation. Write today for full information. If you have a particularly tough problem, describe it . . . Purolator has the solution.

Filtration For Every Known Fluid

PUROLATOR

PRODUCTS, INC.

RAHWAY, NEW JERSEY AND TORONTO, ONTARIO, CANADA

Circle 142 on Inquiry Card for more data

ENJAY BUTYL fabulous new rubber

Helps give you a thrilling new outlook

This profile of elegance is accented by sweeping glass . . . by dramatic new wrap-around windshields made possible by Enjay Butyl. This versatile rubber cushions and protects the glass, prevents squeaks and leaks. Because Enjay Butyl outperforms natural and other types of rubber – lasting longer, weathering better, staying flexible – it is now put to more than 100 uses in today's new cars.

ENJAY BUTYL®

ENJAY COMPANY, INC., 15 West 51st St., New York 19, N. Y.

Other Offices: Akron · Boston · Charlotte · Chicago · Detroit · Los Angeles · New Orleans · Tulsa

Save the cost of tooling up! . . . Specify Spicer components in your new axle design

The easy, economical way to design even the most unusual new axle is to build it around one or more Spicer components...this stock differential assembly, for example.

So why not recheck your blueprints? 9 out of 10 times you'll find Spicer can deliver just the differential assembly you need for your latest front or rear driving axle . . . at a fraction of the cost of producing a new design.

What's more, samples can be obtained quickly for any new development program.

The easiest way is to contact your Dana representative. He'll be glad to match up any number of Spicer axle components to create . . . at the lowest possible cost . . . just the axle you have in mind.

Spicer also has a line of rear and front driving axles with load carrying capacities from 1000 to 7500 lbs.

Be sure to write for Bulletin No. 364. It gives you all the dimensions you need to start designing with Spicer differential assemblies.

DANA Spicer

DANA CORPORATION • **Toledo 1, Ohio**

DANA PRODUCTS Serve Many Fields:

AUTOMOTIVE: Transmissions, Universal Joints, Propeller Shafts, Axles, Powr-Lok Differentials, Torque Converters, Gear Boxes, Power Take Offs, Power Take-Off Joints, Clutches, Frames, Forgings, Stampings.

INDUSTRIAL VEHICLES AND EQUIPMENT: Transmissions, Universal Joints, Propeller Shafts, Axles, Gear Boxes, Clutches, Forgings, Stampings.

AVIATION: Universal Joints, Propeller Shafts, Axles, Gears, Forgings, Stampings.

RAILROAD: Transmissions, Universal Joints, Propeller Shafts, Generator Drives, Rail Car Drives, Pressed Steel Parts, Traction Motor Drives, Forgings, Stampings.

AGRICULTURE: Universal Joints, Propeller Shafts, Axles, Power Take-Offs, Power Take-Off Joints, Clutches, Forgings, Stampings.

MARINE: Universal Joints, Propeller Shafts, Gear Boxes, Forgings, Stampings.

Many of these products manufactured in Canada by Hayes Steel Products Limited, Merritton, Ontario

Circle 143 on Inquiry Card for more data

Executive Earnings in the Automotive Industries

(*Continued from page* 63)

The mathematically fitted relationship between the total compensation of chief executive officers and the level of net sales, net profits, and total assets for 10 companies is shown in Fig. 1. Unfortunately, the automotive vehicle industry includes relatively few companies, whose sizes and complexity vary so widely that Fig. 1 is useful more as a base of reference than as a precise analytical tool. To fix a realistic compensation measure for the chief executive, other means must be employed as well.

(b) Parts Manufacturers

Net sales of automotive parts manufacturers increased along with sales of the vehicle manufacturers. During 1957, parts companies boosted their total sales 6.9 per cent over the previous year. Slightly over half of the reporting 41 companies registered gains. But despite the over-all gain in sales volume, net profits slipped 1.6 per cent from the 1956 level, foreshadowing the price squeeze in which a vast number of parts manufacturers now find themselves. In response to this loss of profits, the income of chief executive officers declined by 1.2 per cent.

Fig. 2 shows the mathematically fitted relationship between the total compensation of the parts manufacturers' chief executives and corresponding levels of sales, profits, and total assets.

Figs. 3, 4, and 5, which follow, show three comparisons, relating chief executives' compensation to company sales, net profits, and assets. Each of the three figures has two lines drawn between the dots (with each dot representing a chief executive's total compensation). The solid line is mathematically fitted to compensation of the chief executives; and the broken line is the average total compensation of chief executives in 18 key industries.

From these graphs it is evident that chief executives in the automotive parts industry received somewwhat higher total compensation than the average chief executive. Fig. 3 shows this to be true on the basis of sales volume. Fig. 4 shows similarly that the chief executive's compensation in automotive parts companies is significantly higher than that in industry generally based on net profits—particularly at the lower end of the profit scale. Fig. 5 shows a comparison based on the magnitude of total assets, where again compensation levels for automotive parts executives appear to be higher than the industry average at all size levels.

How the 18 key industries' sales, profits, and compensation levels in 1957 compare with those in 1956 is shown in Table I.

It will be noted in the table that, in the automotive parts industry, chief executives' compensation seems to be more sensitive to shifts in net profits than to changes in sales volume.

WHAT ABOUT OTHER EXECUTIVES?

As in all industries, in automotive companies the chief executive's compensation sets the pattern for the compensation levels of his subordinate executives. But the difference between the top man's earnings and those of his nearest subordinates is much smaller in the vehicle manufacturing industry than in the parts manufacturing industry.

This difference can be seen if one looks at the compensation of the second, third, and fourth highests paid executives as a percentage of the chief executive's earnings. As Table II shows, vehicle manufacturing executives get a higher percentage of their top men's earnings than do corresponding executives in a 23-industry group. Parts manufacturing executives, on the other hand, fall below the 23-industry average.

This picture has not changed significantly from the previous year. The stability in the relation between the top four executives in-

dicates that compensation changes, over the years, of the chief executive officer set the pattern for the other members of the top-level group.

THE OUTLOOK

It is clear from an anlysis of 1956 and 1957 figures for the automotive industries that executive compensation has been very sensitive to profits.

The outlook for 1958 and 1959 indicates that large fluctuations in automotive profits can be expected. In 1958 the hoped-for "good year," predicted by some top automotive executives as late as last December, has not materialized. Even a good fourth quarter will not be likely to turn 1958 into a good sales year. Hence 1958 will undoubtedly be a poor year for profits for the automotive industries.

But 1959 will probably be much better. The record for the 1958 model-year indicates that depressed demand was related to economic conditions rather than to any mass resistance to styling or other product characteristics. At the time of writing, almost every major indicator of economic activity points upward. In many industries the recession is already over—a hopeful sign for the automotive industries in 1959.

It will be interesting to note the degree to which compensation in the automotive industries continues to follow resulting fluctuations in profit performance. ■

BOOKS ...

AVIATION DICTIONARY AND REFERENCE GUIDE, *revised by Ernest J. Gentle & Charles E. Chapel, published by Aero, Inc., 2162 Sunset Boulevard, Los Angeles 26, California. Price $7.50.* This standard authority on aviation terms, along with the aeronautical reference guide, have been revised and brought up-to-date, to help meet the demands of this rapidly changing industry. Since the aviation industry of today has a much wider scope than that of a few years ago, over 2000 new definitions have been added on a number of subjects that are now covered in this expanded volume. Thus, this new and enlarged edition now includes a total of 7000 terms on all phases of the aviation industry. The reference guide section consists of hundreds of pages of text materials, photos, diagrams, drawings, tables and charts. New and up-to-date information has also been added to this reference section, thereby making this one volume a valuable encyclopedia of aviation information.

SHORTIES

Almost three out of every four new cars sold were for replacement of the 4,250,000 used cars scrapped last year. Also scrapped in the same period were 625,000 trucks and buses.

•

Eight states have half of all passenger car registrations in the U. S. California leads, followed by New York, Pennsylvania, Ohio, Texas, Illinois, Michigan, and New Jersey.

•

R&D spending by both government and industry for aircraft, missiles, and spacecraft soared from $758 million in 1953 to $2.1 billion in 1956, a gain of 177 per cent.

•

A turbopump feeds fuel into a rocket engine at a rate that would empty a railroad tank car in two minutes.

•

A jet fighter squadron today requires about seven times and a jet bomber squadron about ten times the total horsepower needed for World War II planes.

•

Nationwide registrations of all motor vehicles have jumped more than 53 per cent in the past ten years—from 44.6 million in 1949 to an estimated 68.5 million by the end of 1958.

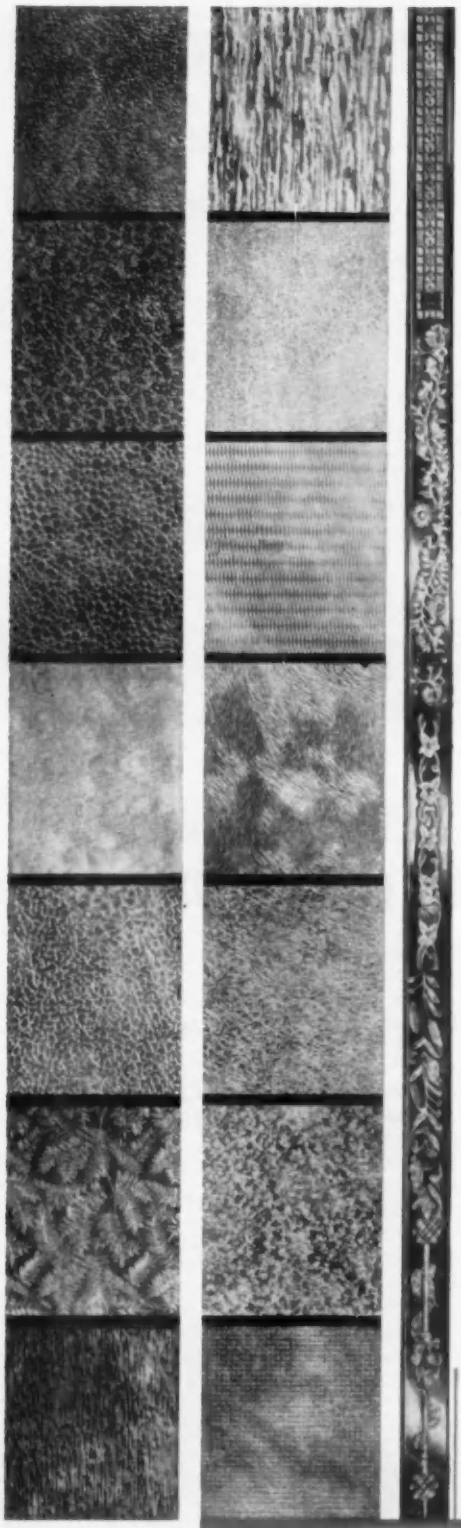
•

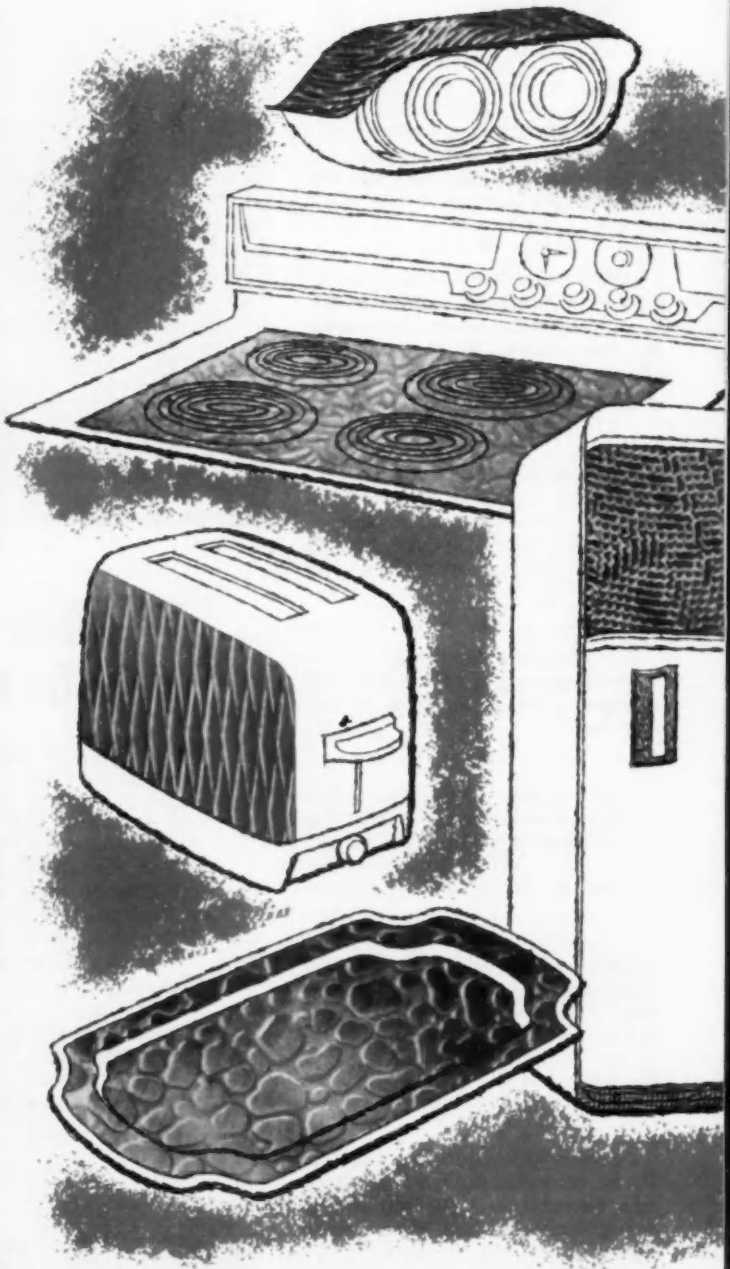
Nearly three-quarters of all U. S. households have at least one automobile, and one out of every eight families have two or more cars.

•

Ballistic missiles in fiscal 1959 will account for about one-half the $2.8 billion slated for all Air Force missile programs. This amount does not include research and development, or construction requirements.

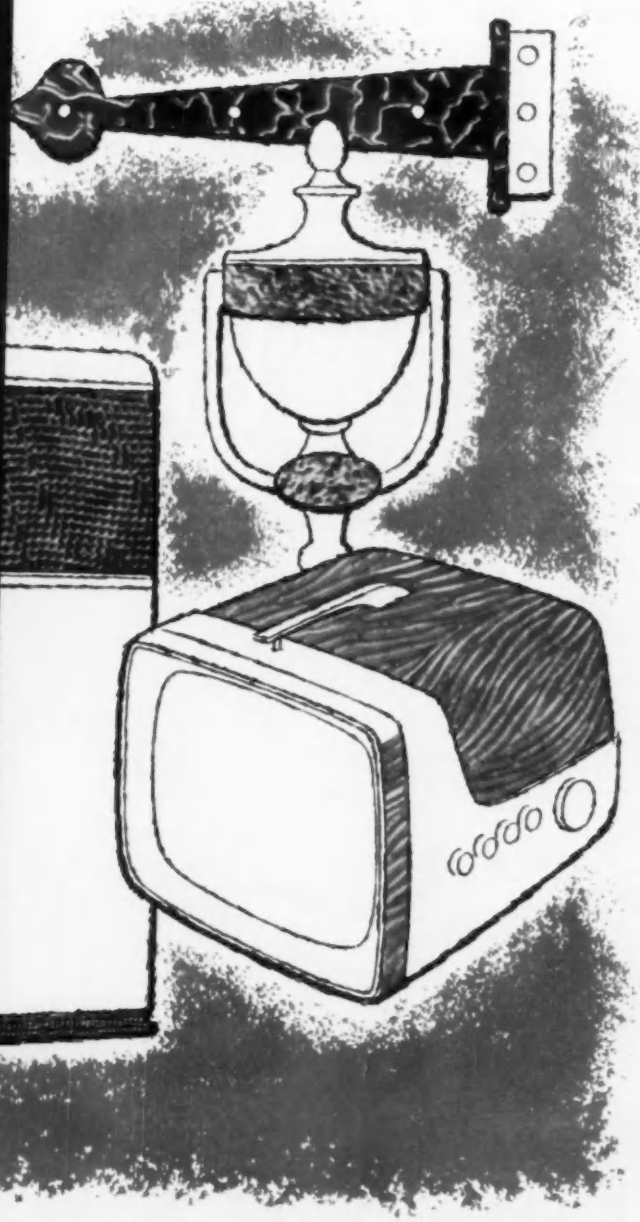
New way to





New patterns . . . Here are 19 new embossed Amerstrip patterns. They can be used on any consumer product made of strip steel, such as: escutcheons, hinges, door knockers, TV and radio cabinets, lamps, table tops, trays, dashboards and kick panels, small appliances, and large appliances.

add beauty and "sell" to consumer products



. . . embossed USS Amerstrip

HERE are just a few examples of the way in which embossed Amerstrip steel can enhance the beauty—and salability—of products made with strip steel. And this is *permanent* beauty . . . beauty you add to your consumer products at low cost.

New embossed Amerstrip is an inexpensive way to add charm and distinction to products because you do not have to apply the pattern; the designs are etched on rolls, then pressed into the strip at our strip mill. Once these patterns are applied, they cannot come off; they are permanently rolled into the steel. A wide variety of new patterns are now at your disposal. Embossed Amerstrip has been experimentally fabricated into products to prove that cold drawing does not affect the pattern. It actually draws easier because the pattern helps hold the lubricant.

Embossed Amerstrip has any number of possible applications, including automobile trim, appliances, hardware, and furniture. New embossed Amerstrip—like all types of Amerstrip—is made to meet the standards of highest quality. American Steel & Wire Division has a large, competent technical staff to help you select the embossed Amerstrip your product needs. Put extra beauty—and customer appeal—in your product with embossed Amerstrip Cold Rolled Strip Steel. For full information, call our nearest sales office. American Steel & Wire, 614 Superior Ave., N. W., Cleveland, Ohio.

USS and Amerstrip are registered trademarks

American Steel & Wire Division of USS United States Steel

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors • Tennessee Coal & Iron Division, Fairfield, Ala., Southern Distributors • United States Steel Export Company, Distributors Abroad

SAE National Aeronautic Meeting

(*Continued from page 57*)

(d) Finish machine them.
(e) Attach the required edge members by brazing, welding, or mechanical joining.

This material is now used for engine nacelles and wing trailing edges of supersonic aircraft.

High Temperature Plastics

Plastics may surpass metals as structural materials for very high speed missiles. So suggested Irving J. Gruntfest of General Electric's Aerosciences Laboratory. He was speaking about phenolic plastics reinforced with glass or nylon fibers.

As a missile nose cone rushes along at a speed of thousands of miles per hour, it heats up the air it meets. The gases are hot enough to melt a metal and cause it to trickle away quickly. But plastic parts exposed to these high-temperatures break down into enormous volumes of gases. These shield the remaining plastic from the heat of the airstream. The plastic decomposes slowly and, in doing so, absorbs considerable heat.

Mr. Gruntfest's paper, "Use of Plastics at High Temperatures," dealt with the problem of selecting materials for the skins of hypersonic vehicles. Some research programs have to consider gas temperatures from 5000 to 7000 K near the body during flight.

Scientists are uniformly pessimistic about the prospects of discovering solid materials which will be stable at such temperatures. So designers have resorted to some rather novel and ingenious devices and systems. They hope these will insure the survival of the vehicle until it completes its mission.

One possible solution is use of organic plastics. Even though these substances are not stable above 300 or 400 C, they may fail slowly enough to be useful. We also must consider heat sink or transpiration cooling devices.

Hardware costs run high. "In flight" testing is complex. Much effort, then, must go into "preflight" screening of prospective materials. Even laboratory-scale work is very costly because it's so difficult to simulate the relevant environments. However, it's most important to have a basic understanding of the interaction of very hot gases with various materials. This would make more accurate the predictions of behavior from laboratory conditions to those in flight.

Mr. Gruntfest described some work done in the field, some with organic plastics. These might also prove to be a practical material for parts exposed to the exhaust gases of rocket motors.

Two rather important facts emerge from various studies. One is that there is no single high temperature problem. The optimum

material for one mission may be quite inferior for another. Also chemical considerations can be quite as crucial as mechanical and other physical properties in the selection of materials.

Quieting the Jets

Three years of intensive research have paid off for engineers trying to muffle the sound of jet engines without power loss. They've developed a device which cuts the sound to acceptable levels. It also shortens the landing roll of a big jet transport. How the combined noise suppressor and thrust brake was worked out for the DC-8 Jetliner was described in a paper by two Douglas Aircraft engineers, L. R. Jordon and C. M. Auble.

When the project started, the company set goals of 9 to 12 decibels sound reduction and at least 40 per cent of full power in reverse thrust. The device now in production, the paper reported, "meets or exceeds the performance objectives originally set up."

Nozzles of various shapes were attached to the jet outlet to speed up the mixing of exhaust with outside air. Quicker mixing is one way of reducing the sound level; but changing the shape of the outlet reduces engine power. Any protuberance also increases drag of the airplane.

Douglas engineers worked up an "ejector" device to supplement the mixing nozzles. They got the desired amount of noise suppression.

The "ejector" is a cylinder extending beyond the exhaust nozzle during take-off. It not only decreases the sound three to four decibels but increases the take-off thrust enough to offset the loss caused by the nozzle, the paper said. The combined corrugated nozzle and ejector cylinder effected the desired amount of noise reduction.

For a thrust brake the engineers found that the "target" type was the most logical. Its contoured doors mounted behind the exhaust nozzle turn the exhaust force forward. These doors are built into the ejector cylinder, normally lying flush with the sides. They close during braking.

Processing Wrought Steel

High strength wrought steel is here to stay as a member of the family of available materials for airframe construction. That's the opinion of L. H. McCreery, supervisor, Engineering Structures Materials, Chance Vought Aircraft, Inc., in "Processing Wrought Steel to High Strength."

Aircraft like his company's Crusader owe their high performance characteristics in part to weight saved through use of high strength steel parts — structural parts at 260,000 psi minimum ultimate strength.

The Crusader won the 1957 Collier Trophy for outstanding achievement by a production aircraft. It took the Thompson Trophy in 1956 with an average speed of over 1000 mph. And it was first to fly non-stop from a Pacific to an Atlantic based car-

rier in a little over three hours. It was first to cross the continent at an average speed greater than the speed of sound. Total elapsed time; 203 min.

The airframe industry, Mr. McCreery said, has just scratched the surface in extremes of strength and in use of parts processed to high strengths. High-strength parts require precision processes. The high degree of precision needed was unheard of a few years ago. And it's still considered by most processors and suppliers as utterly ridiculous. Every process involved in fabricating such structural parts must be brought under rigid control. This applies even to making the steel.

Summing up, Mr. McCreery said that processing of 4340 steel to high strengths is completely feasible. He urges these precautions:

(1) Be sure the steel used can take heat treating to high strength with significant ductility.

(2) Be sure that rolling or forging is done in a quality manner with no overheating or burning.

(3) Be sure that machining is done carefully and completely.

(4) Be sure that heat treatment is completely adequate as to process, times, and temperatures.

(5) Be sure the part isn't ruined in the finishing operation through embrittling or cracking under the finishing material.

(6) Be sure that inspection checks of vendors, processes, and parts are both adequate and frequent.

Fabricating Exotic Materials

In covering "Fabricating Exotic Materials," W. A. Mays, North American Aviation, Inc., listed five metals that are good candidates for airframe parts requiring elevated temperatures. They are high strength precipitation hardening stainless steels, Rene 41, H.S. 25, molybdenum, and niobium (columbium). All can be fabricated with conventional equipment, for the most part.

Mr. May made these points about fabricating the "exotics":

(1) Power requirements for

(*Turn to page* 106, *please*)

One of the most efficient manufacturing operations in industry today is the production of automobile frames. For better, faster descaling, three of the four producers in this field have selected Pangborn Rotoblast Descaling Equipment.

ROTOBLAST replaces pickling at Midland Steel.

Clean it fast with **Pangborn** *ROTOBLAST®*

PANGBORN CORPORATION, Hagerstown 11, Maryland
Manufacturers of Blast Cleaning and Dust Control Equipment

Circle 149 on Inquiry Card for more data

A chain

. . . a dependable, durable, safety-forged chain of *matched* links guaranteeing specific job performance . . . or it can be an assembly of distantly related, oddly assorted, individualized links.

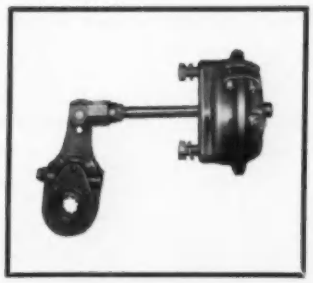
And this is true also of the chain of devices that comprise an air brake system.

When you specify Bendix-Westinghouse Air Brakes for your vehicles, you can be certain you are buying a system-engineered chain with a proven performance record. It is a *complete* chain because every device, every single component, is designed and built to perform a specific function

is what you make it...

with peak efficiency in a *closely related* system. And because it is a complete chain it will pay you dividends in terms of greater dependability, longer trouble-free service with extra safety and economy.

When you buy new equipment be sure to specify a *complete* Bendix-Westinghouse Air Brake system . . . a system for whose performance, dependability, and long life we accept complete responsibility. Thousands of truck and bus operators know this. That is why more trucks and buses are equipped with complete Bendix-Westinghouse Air Brake systems than by all other makes combined.

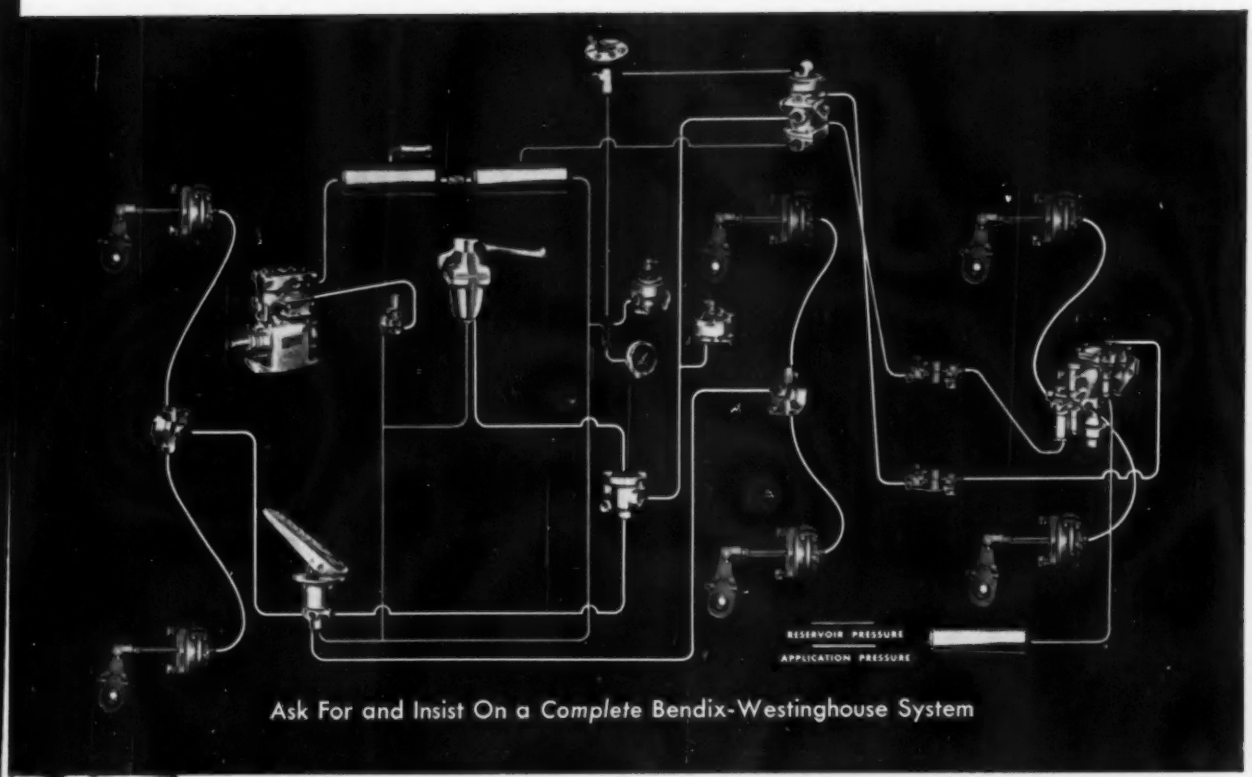


Typical of many dependable devices designed and built by Bendix-Westinghouse are slack adjusters and brake chambers—perfectly matched and precisely built links in the dependable, durable, safety-forged chain you get when you buy a *complete* Bendix-Westinghouse Air Brake system.

Bendix-Westinghouse

AUTOMOTIVE AIR BRAKE COMPANY

General offices and factory—Elyria, Ohio. Branches—Berkeley, Calif. and Oklahoma City, Okla.



Ask For and Insist On a *Complete* Bendix-Westinghouse System

SAE National Aeronautic Meeting

(*Continued from page* 102)

forming will be as high or even higher than for stainless steels.

(2) Some operations will need circulating air furnaces with a temperature range of 1400 F to 2400 F.

(3) Use vacuum or inert gas (argon or helium) for molybdenum and columbium.

(4) Hot forming and shearing are needed for fabricating molybdenum.

(5) New forming techniques—explosive forming, explosive piercing, and punching — may prove useful.

(6) These metals are not cheap and manufacturing experience will be costly.

Low-Quantity Low-Rate Production

There was a panel on "Low-Quantity and Low-Rate Production" led by F. R. Kundes and B. Halperin, both from Douglas Aircraft, Long Beach, Calif. Just what is low quantity and low rate? Making about one or two a month for a period of one or two years.

The panel pointed up that the aircraft-missile industry right now is veering away from the high production concept of the past years.

Low rate production calls for mechanics with greater aptitude to perform a variety of assignments. R. E. Horwat, foreman, Sub-Assembly and Major Structures, Northrop Aircraft, Hawthorne, Calif., said supervisory staffs won't be cut by much with small group use. Their coordination with Inspection and Engineering will increase.

Leadmen, like the mechanics, must be more versatile; yet their chances for promotion are limited. Training programs should be set up to develop the needed skills. Published schedule revisions are necessary for efficient operation. These are basically the requisites of low quantity and low rate production from a manufacturing organizational standpoint.

This concept, Mr. Horwat pointed out, "is not by our choice but by customer requirements . . ."

D. W. Kraybill, chief tool project engineer, Chance Vought Aircraft, Dallas, Texas, had this to say on tooling for low quantity and low rate production: (1) The entire line organization has to have an understanding of this new philosophy. Each project must have a tool project book (control document) for issue to Tooling and Production.

(2) Fabrication tooling will become more complex with use of new materials and closer tolerances.

(3) Assembly operations will be concentrated in the final assembly

(*Turn to page* 110, *please*)

Another Tinnerman Original...

Nut-in-a-cage eliminates welding or staking... **SPEED GRIPS**® hold themselves on panels!

Wherever you require a heavy-duty, multi-thread, self-retaining fastener, a Tinnerman SPEED GRIP Nut Retainer answers the need, holds down assembly costs.

SPEED GRIPS snap into place... some into panel holes... others over panel edges. No special tools or skills required. Spring-steel fingers grip the panel, yet let the nut float to compensate for normal panel-hole misalignment. Welding, staking and clinching are eliminated. SPEED GRIPS can even be applied after panels have been finished, avoiding paint-clogged threads.

SPEED GRIPS are available in a wide range of sizes and types, including front-mounting nut and bolt retainers for hard-to-reach or blind locations.

See your Sweet's Product Design File, section 8-T for data on these and other SPEED NUT Brand Fasteners. Your Tinnerman representative has complete information and samples. If he isn't listed under "Fasteners" in your Yellow Pages, write to:

TINNERMAN PRODUCTS, INC.
Dept. 12 • P.O. Box 6688 • Cleveland 1, Ohio

TINNERMAN
Speed Nuts®

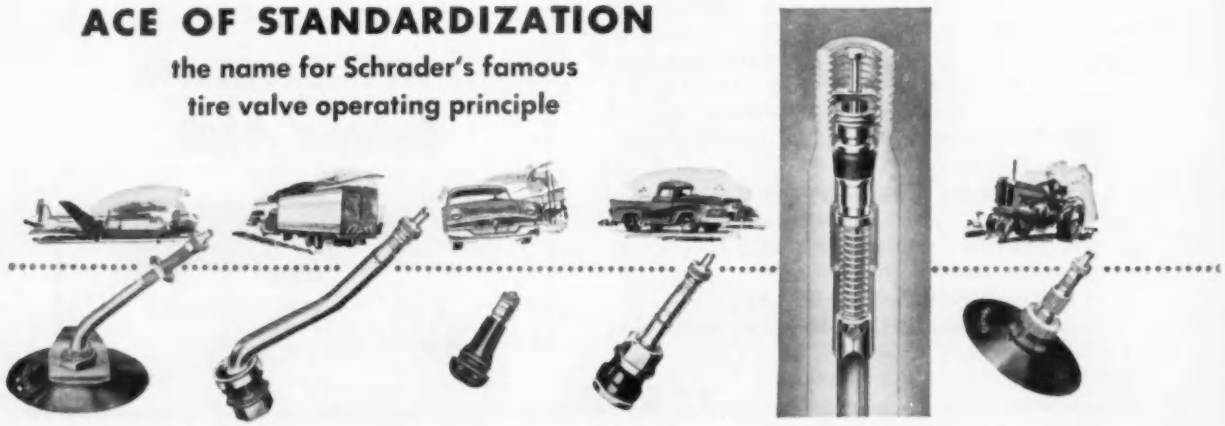
FASTEST THING IN FASTENINGS®

CANADA: Dominion Fasteners Ltd., Hamilton, Ontario. GREAT BRITAIN: Simmonds Aerocessories Ltd., Treforest, Wales. FRANCE: Simmonds S.A., 3 rue Salomon de Rothschild, Suresnes (Seine). GERMANY: Mecano-Bundy GmbH, Heidelberg.

ANYWHERE IN THE WORLD...ANYONE

ACE OF STANDARDIZATION

the name for Schrader's famous tire valve operating principle



CAN AIR-SERVICE TODAY'S TIRES

years of tire valve standardization make it easy

On the other side of the world, servicemen are using the same American tools, parts and methods to service vehicles as the man in the station down the block. Tire service is fast and easy because of standardization, but this situation didn't just happen. The U. S. Automotive, Tire and Tire Valve Industries combined their skills and experience not only to maintain highest quality while mass producing at lowest cost, but to produce interchangeable air valves and tools that make service possible anywhere a vehicle goes. Schrader's job is to utilize all the Industry know-how and produce the safest, most practical and dependable valves for all types of pneumatic tires.

Count on quality Schrader Tire Valves to match the performance of your vehicles . . . because the "Ace of Standardization" design can be serviced anywhere in the world.

Schrader®
a division of SCOVILL

A. SCHRADER'S SON • BROOKLYN 38, N. Y.
Division of Scovill Manufacturing Co., Inc.

FIRST NAME IN TIRE VALVES

FOR ORIGINAL EQUIPMENT AND REPLACEMENT

Circle 153 on Inquiry Card for more data

SAE National Aeronautic Meeting

(*Continued from page* 106)

area, with many less break-back or sub-assembly tools being provided.

(4) A Universal Erector Type major assembly dock may develop.

(5) There will be fewer interchangeable items. This, as well as the new concept of tooling, will cut the need for master tools and increase the use of advanced optics.

Methods of Metal Removal

Metal removal from high temperature materials got a first rate going over. The men on this panel put in a great amount of time in preparation. All were excellent.

Manufacturing engineers are faced with many new problems. One is how to handle, form, and machine materials that can withstand pressures, heat change, and stress considered impractical several years ago.

There are relatively new machining processes that use the erosion principle for precision material removal. Electrical discharge, electrolytic, and ultrasonic are three of them.

Here's the way W. F. Wagner, supervisor of design producibility and standards, Northrop Aircraft, analyzes them. Essentially, the electrical discharge method uses an intermittent high frequency spark to remove material. Both the electrode and the work piece are submerged in a non-conductive or dielectric fluid.

In the electrolytic method, usually applied to grinding and cutoff work, there's a simultaneous combination of abrasive grinding and electrolytic erosion. The operation is performed with a conductive electrode wheel, embedded with abrasive grains that protrude slightly above its surface. A continuous low-voltage direct-current power supply is used. Both the electrode wheel and the workpiece are submerged in a non-corrosive conductor fluid.

The ultrasonic method uses no electric current for direct material

(*Turn to page* 113, *please*)

For buy appeal, lasting eye appeal... more Nickel plating under new car chrome

Tough, durable Nickel plating underneath new car chrome assures lasting beauty.

That's because good heavy Nickel plating does three things:

(1) It makes a smooth, white-metal foundation for a brilliant chrome finish.

(2) It protects the steel and other base metals from rust and corrosion.

(3) It backs up the chrome surface and keeps it from cracking under impact.

Those are the reasons why your customers can keep their trim showroom-bright, for years and years, with just ordinary washing.

Nickel gives your car trim lasting beauty . . . the lasting eye appeal you need to keep your customers sold!

The International Nickel Company, Inc.
67 Wall Street New York 5, N. Y.

Inco Nickel

Makes metals perform better longer

Nickel plating...under chrome ...over steel: That's how a good bumper finish is built up. Chrome gives you shining beauty. Nickel plating makes the beauty last. Steel is for strength and safety.

Aeronautic Meeting

Lipe

DIRECT PRESSURE CLUTCH

Vital component in today's most economical system of power transmission, the Lipe DPB Heavy-Duty Clutch costs less at the start... materially reduces the competitive selling price of the vehicle . . . and affords substantial savings in over-all truck-operating costs per mile.

Other elements of the power-train contribute to these savings, but the Lipe DPB Heavy-Duty Clutch absorbs the greatest shocks and fiercest friction, dissipates the most heat, and by its simplicity, direct drive, easy adjustment and replacement-exchange, keeps the vehicle rolling with less cost for fuel, brake relining, oil replenishment and repair. Its worth in highway safety and preventative brake maintenance alone places it far in advance of costlier and more complicated drive components.

Advanced thermodynamic design and positive air circulation add up to a heavy-duty clutch of uncomplicated design with few moving parts. In short, it's a clutch with a low maintenance cost that matches both its low first cost and greatly lower truck-mile costs of operation.

● Lipe DPB clutches now available in 12", 13", 14", 15" single and two plate models. Write for engineering data sheets on the sizes which interest you.

LIPE ROLLWAY

Lipe-ROLLWAY
CORPORATION
SYRACUSE 1, N. Y.

MANUFACTURERS OF AUTOMOTIVE CLUTCHES AND MACHINE TOOLS

Circle 185 on Inquiry Card for more data

Aeronautic Meeting

(*Continued from page* 110)

removal. It produces mechanical erosion by means of a tool pulsating at ultra-sonic speeds. The tool bombards the work piece with grit bearing fluid supplied to the work area by a continuous flow pump. You can use all three of these methods, where applicable, on electrically conductive materials, Mr. Wagner says. Only the ultrasonic principle is usable on nonconductive materials.

In his part of the panel, Mr. Wagner tackled electrical discharge machining. It can make, at the same time, multiple cavities and holes of various geometric shapes in all conductive materials to tolerances of ±.0005 in. It has no detrimental effect on either microstructure or impact properties. It creates no stress or warpage in the part being machined. It is usable on both new work and rework of tools which could not be salvaged in any other way.

The method will surface finish in the order of 10-20 micro-inches without scratches, heat checks, waviness, or chatter.

Electrical discharge machining works well on the newer, harder, and higher temperature resistant materials. They range from difficult to nearly impossible to machine by conventional methods.

Mr. Wagner feels that the potential of this process to industry in general depends largely on (1) user ingenuity; (2) development of cheaper operational techniques; and (3) larger and more sophisticated equipment to handle configurations now in the design stage.

Future of Chem-Mill Process

What about future applications of the Chem-Mill process? Two experts from North American Aviation's Missile Division—M. C. Sanz, chief laboratory scientist, and C. C. Shepherd, senior research engineer—believe the process will continue to widen in scope and become applicable to new metals and alloys. Research groups are already attacking the challenges offered by new steel and titanium

(*Turn to page* 116, *please*)

ON OUR WASHINGTON WIRE

The White House reaffirmed its intention of clamping price controls and issuing rationing orders at any time it believes an "emergency" exists. These points were spelled out in a recent master plan for the non-military defense of the nation issued by the Office of Civilian and Defense Mobilization.

OCDM thus is putting the nation's manufacturers on notice that it does not intend to wait for the Congress to enact such controls after an emergency arises. The planners are proceeding on the theory that in time of national emergency they'll act first and worry later about the legality of what they've done.

Some businessmen are concerned over what constitutes a "national emergency." OCDM won't necessarily wait until the bombs drop. A politician's idea of an "emergency" may be quite different from management's. In other words we may get price controls and rationing without actually being at war.

OCDM, which prepared the so-called master plan for national mobilization, is a planning agency—not an operating agency. Thus, while it can order nation-wide price controls into effect by the stroke of a pen, it won't actually enforce them. A new government agency, modeled after OPA of World War II and OPS of the Korean War, will actually police the prices.

Pentagon procurement officials and some contractors are baffled over problems of "responsible bidding." Both complain that experience contractors usually fall in middle area when trying for reorders. Low bids often obviously contain miscalculations. But they must be accepted. The eventual result when projects are underway, is that supplemental payments are needed, raising costs.

Lt. Gen. Arthur G. Trudeau, chief of Army research, says there never would have been a MIG over Korea if Britain had not made jet engines available. Specifically Gen. Trudeau says the British Labor government sold the U.S.S.R. jet engines which turned up as the power plants in the Russian MIG-15 fighters in the Korean war.

Soviet technology has made great strides as a direct result of information obtained from U. S. industry, he asserts. By visits to U. S. plants, by reading U. S. manuals and journals, and by the sale or outright gift of equipment, Soviet engineers are today well informed on virtually every U. S. technological achievement of recent years.

what do you want

from your bearing supplier?

It is interesting to note the reasons given by leading vehicle manufacturers for their use of BCA ball bearings as original equipment.

Product quality, of course, ranks first in importance.

Prompt, as-promised delivery scored very highly.

BCA engineering assistance was rated by many as being of prime importance.

BCA has had over half a century of specialized experience in the design and manufacture of ball bearings for car, truck, bus, tractor and farm implement manufacturers. Many of our customers have credited BCA with having made valuable contributions toward reduction of production costs and improvement of operating efficiency of their vehicles. We may be able to help you.

BCA

BEARINGS COMPANY OF AMERICA

DIVISION OF

Federal-Mogul-Bower Bearings, Inc.

Circle 158 on Inquiry Card for more data

(*Continued from page* 113)

alloys, and molybdenum, niobium, and zirconium. They're trying for higher-strength, lighter-weight structures.

Continued rapid growth of chemical milling will depend on the combined ingenuity of chemists, process and design engineers, and manufacturing groups in solving present and new fabrication problems. The process will become applicable to a wider range of design problems, and in industries other than aircraft, as more become known about reaction mechanisms and processing techniques.

Abrasive Belt Machining

M. M. Gilman, senior tool engineer, North American Aviation, tackled "Machining With Coated Abrasive Belts." An increase in sheet thickness of only .001 in. will increase the weight of some proposed airframes by as much as a ton. This highlights the need for close tolerances in skin sizing. Abrasive belt machining answers this need.

Another close tolerance need arises from use of brazed honeycomb sandwich in today's and tomorrow's airframes. To insure a subsequent braze, engineers at North American Aviation permit a maximum burr tolerance of .005 in. and a maximum clearance between facing sheets and core of only .004 in. Abrasive belt machining does the job.

The method gives high removal rates, accuracy, and less distortion. It's also the most efficient metal removal method in deburring and specialized cleanup. More uses depend only on the ingenuity of the manufacturer and designer. Abrasive belt machining is only in its infancy.

Problems of Space Voyagers

Space voyagers on a 1000-day round trip to Mars will have to carry a "do-it-yourself" oxygen kit.

A space travel man of Douglas Aircraft said it will be impractical to carry an adequate supply of oxygen. It will have to be made en route on trips lasting weeks or longer.

(*Turn to page* 118, *please*)

NEW TUNG-SOL

HEAVY DUTY FLASHER

...built with *twice the life* of other types

For trucks, tractor-trailers, buses, taxis, boat and car trailers, passenger cars

Tung-Sol engineers have incorporated in this new heavy duty flasher all of the sought-after characteristics for fleet application—longer life, flexibility and lower maintenance costs.

The new Tung-Sol heavy duty flasher has a service-rated life of twice that of any other type. It can be used to flash one to six lights without a perceptible change in the flashing rate. It delivers an instantaneous four-lamp emergency warning and it will replace 95% of the flashers now in use. This new flasher will provide more positive action and greater dependability. Made in the universal form, it can be used in either a plug-in or screw terminal installation. Electroswitch Division, Tung-Sol Electric Inc., Newark 4, N. J.

6 and 12-Volt Types

6-Volt—#535 flashes from one to six 21cp lamps
12-Volt—#534 flashes from one to six 21cp or 32cp lamps

TUNG-SOL® *—First in Flashers*

Aeronautic Meeting

(*Continued from page* 116)

Dr. Eugene B. Konecci, head of the Human Factors Group at Douglas's Tulsa Div., suggested two methods of doing it. Regenerative systems that might be used include biological photosynthesis involving algae or photolysis of carbon dioxide.

Through photosynthesis plants reduce carbon dioxide and oxidize water by the catalytic action of chlorophyll with sunlight as the energy source.

Photolysis, or decomposition of respiratory carbon dioxide with ultraviolet light and a catalyst, is another means of controlling carbon dioxide and returning some of the oxygen for reuse by space cabin passengers.

Dr. Konecci told of experiments in photolysis he conducted in 1952, using copper as a catalyst. He said further experiments are planned, pointing out that the abundance of ultraviolet light in space is one of the advantages of this method.

It won't be enough to provide space fliers an environment they can survive in, a Douglas Aircraft engineer reported. Science must also give them a "thinking environment" so that they can understand and transmit their findings back to earth.

A. M. Mayo, chief equipment and safety research engineer at the El Segundo Div., made this point in a paper on space cabin design.

He said problems of confinement, weightlessness, and other conditions may seriously reduce man's usefulness on prolonged space flights by upsetting his mental equilibrium.

In addition to available rotation methods, artificial gravity may someday be provided by "a constant thrust acceleration" of one G (man's normal weight on earth). Promising research may give us high impulse engines using thermonuclear power and magnetohydrodynamic propulsion.

Mr. Mayo pointed out that such a propulsion system would give continuous direct thrust for long periods. It would greatly cut the flight time of inter-planetary trips.

Today we figure a minimum-energy round trip to Mars at about 970 days. This includes the necessary waiting time there for optimum orbital conditions. A round trip using a constant acceleration and deceleration force of one G would take only 4½ days. Average speed would be nearly 1,000,000 mph.

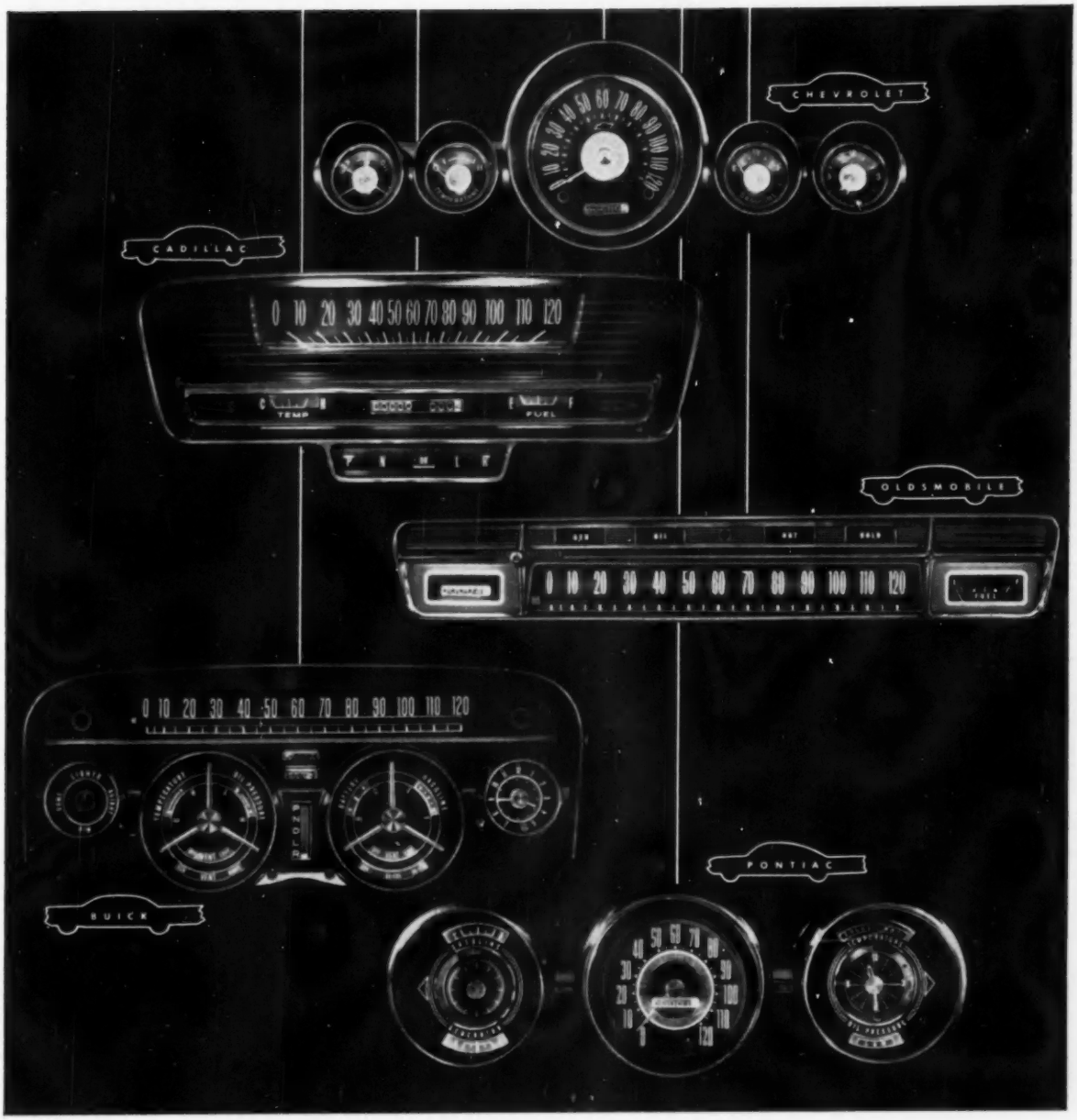
Automation will relieve the pilot of many routine manuel duties. But there will be even more need for "clear human thinking", for complex data correlation, decision making, reprogramming, emergency control, and making repairs in flight.

Many problems need solving before man can have an earth-like environment on outer space excursions. Among these are radiation, temperature, acceleration, noise and vibrations, meteroids and space debris, internal atmosphere, and food and water supply.

• • •

A Lockheed Aircraft engineer,

Instrumental *in Beauty*



AC, long recognized as a volume producer of automotive components, also makes significant contributions toward car beauty. The glamorous 1959 instrumentation assemblies, shown above, illustrate AC's success in blending utility and beauty, function and style. Creativity of the kind so well demonstrated in this new instrument paneling is only one area where AC cooperation is yours for the asking. AC is far advanced in new electronic control concepts, for instance, and solicits your inquiry. Write or phone any of the AC offices:

Watch Walt Disney Studios' ZORRO every week on ABC-TV

AC SPARK PLUG ⚛ THE ELECTRONICS DIVISION OF GENERAL MOTORS

AC

QUALITY PRODUCTS

Flint—1300 North Dort Highway—CEdar 4-5611
Chicago—7074 N. Western Ave.—Rogers Park 4-9600
Detroit—General Motors Building—TRinity 5-2630

Alf Fridtjof Ensrud, received the SAE's Wright Brothers Medal Award. Frank W. Fink, vice-president of Ryan Aeronautical Co. and chairman of the Wright Brothers Board of Award, made the presentation. It's given yearly to the author of the best paper on "aerodynamics, or structural theory or research, or airplane design or construction."

Mr. Ensrud's paper was "Problems in the Application of High Strength Steel Alloys in the Design of Supersonic Aircraft." ■

Machining Power Steering Gear Housing

(*Continued from page 67*)

This has 13 stations, of which Stations 4, 5, 7 and 13 are idle, while Station 8 turns the work 90 deg.

The special operations handled on the small transfer machine may be listed briefly as follows:

Station	Operation
1. LH head	Combination counterbore deep hole and deburr.
2. LH head	Deburr deep hole in full depth.
RH head	Deburr angular hole in cylinder end.
3. LH head	Deburr bottom of valve bore.
RH head	Deburr ¼-in. diameter drill breakthrough at bottom of cylinder bore.
4. LH head	Deburr end of valve bore.
5.	Idle.
6. LH head	Deburr angular hole in valve end.
RH head	Deburr cored opening in cylinder bore.
7. LH head	Air blast long oil hole.
8.	90-deg turntable.
9. LH head	Deburr two hose connection holes
10. LH head	Air blast four side cover holes, and 12 hose connection holes.
11. LH side	Hand deburr edge side cover face.
12. LH side	Automatic rocker fixture for polishing side cover face.
13.	Idle.

The character of the operations listed immediately above indicates that in conventional practice they might be performed on a network of benches and by laborious hand methods. The approach developed by Saginaw is more along the line of modern techniques designed to do the job more rapidly, in less space, at lower cost, and with greater control of quality. ■

GENERAL MOTORS *Announces*

A COMPLETELY NEW SYSTEM OF PRECISION POWER STEERING AVAILABLE EXCLUSIVELY ON 1959 GENERAL MOTORS CARS!

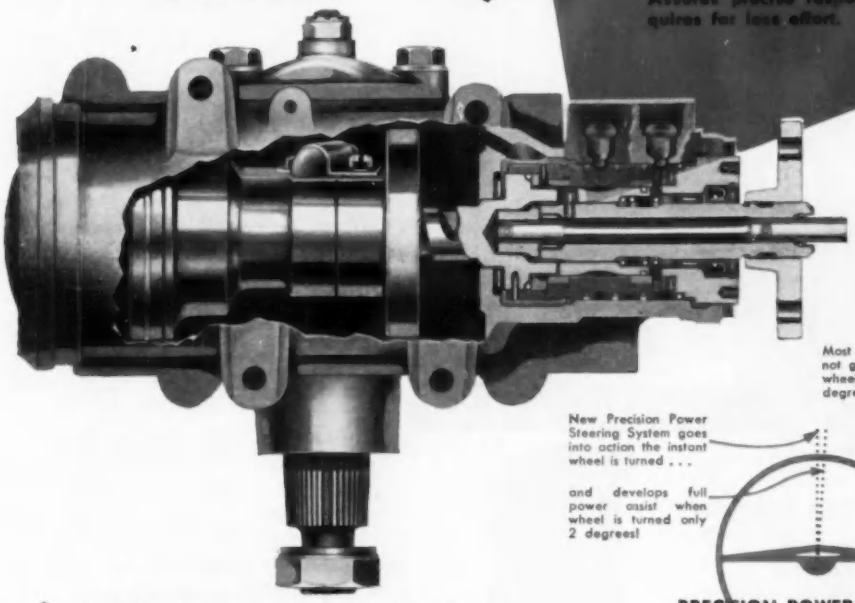
A REVOLUTIONARY ADVANCE IN PRECISION CONTROL!

- OIL FLOW IMPROVED IN SMALLER, COMPLETELY RE-DESIGNED PUMP!

  Delivers *more* oil needed at lower speeds. Delivers *less* oil at high speeds!

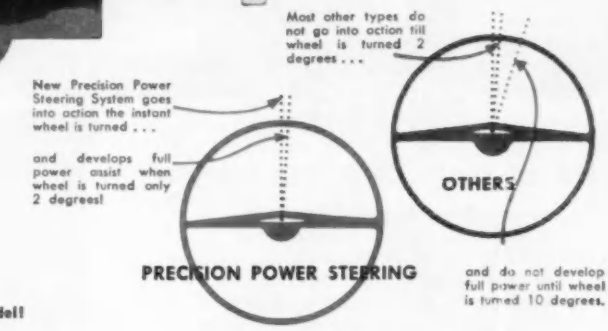
TOTALLY NEW INSTANT-ACTION ROTARY VALVE ROTATES DIRECTLY with STEERING SHAFT and WORM!

Valve eliminates friction and lost motion to control hydraulic power more effectively than ever before! Assures precise response yet requires far less effort.



- **UP TO 5 TIMES GREATER HANDLING EASE THAN COMPETITIVE TYPES!**

  Normal parking requires only 2½ pounds of effort! Actually *improves* natural "road feel" vital to safe, relaxed control!



- **Oil Filler Plug Comes Off By Hand Without A Wrench!**
- **Seventeen Fewer Parts and One Pound Lighter Than Previous Model!**
- **Eliminates Ten Oil Seals to Minimize Servicing Problems!**

THE RESULT IS "PINPOINT PRECISION" HANDLING EASE . . . THE TRULY PRECISE STEERING THAT HAS ALWAYS BEEN THE GOAL OF AUTOMOTIVE ENGINEERS . . . PLUS THE EASE AND SAFETY OF POWER ASSIST!

Saginaw POWER STEERING

SAGINAW STEERING GEAR DIVISION • GENERAL MOTORS CORPORATION • SAGINAW, MICH.

Annual Meeting of the ASBE

(*Continued from page* 64)

cent of plastic prototypes are made full scale by vacuum forming, about 10 per cent in ⅜-scale. The small department, manned by experts, produces something over 500 full scale prototypes during the course of a model year.

Such prototypes have enabled the production engineering department to visualize the structures and avoid unsatisfactory or impractical welding and die problems. Armed with such models, the production department is able to discuss these problems with engineering and obtain modifications prior to freezing the design.

This procedure early enough in the design stage of a new model program saves millions of dollars annually by reducing lead time, engineering manhours, engineering changes, tooling cost, etc. Above all, it effects more cooperative teamwork between manufacturing and engineering.

The several presentations discussed so far highlight the importance of cooperative action among stylists, engineering, and manufacturing. The same approach is inherent in the design and manufacture of ornamental and mechanical hardware discussed at some length by F. O. Riley, director of product engineering and development, Ternstedt Division, GMC. He pointed out that a constant interchange of information between body and hardware engineers is essential from the very beginning. Moreover, the trend to yearly style changes has made it necessary to redesign and retool parts for every model change. This, together with the greater use of power operated accessories has brought about a need for considerably more engineering in the area of automotive hardware.

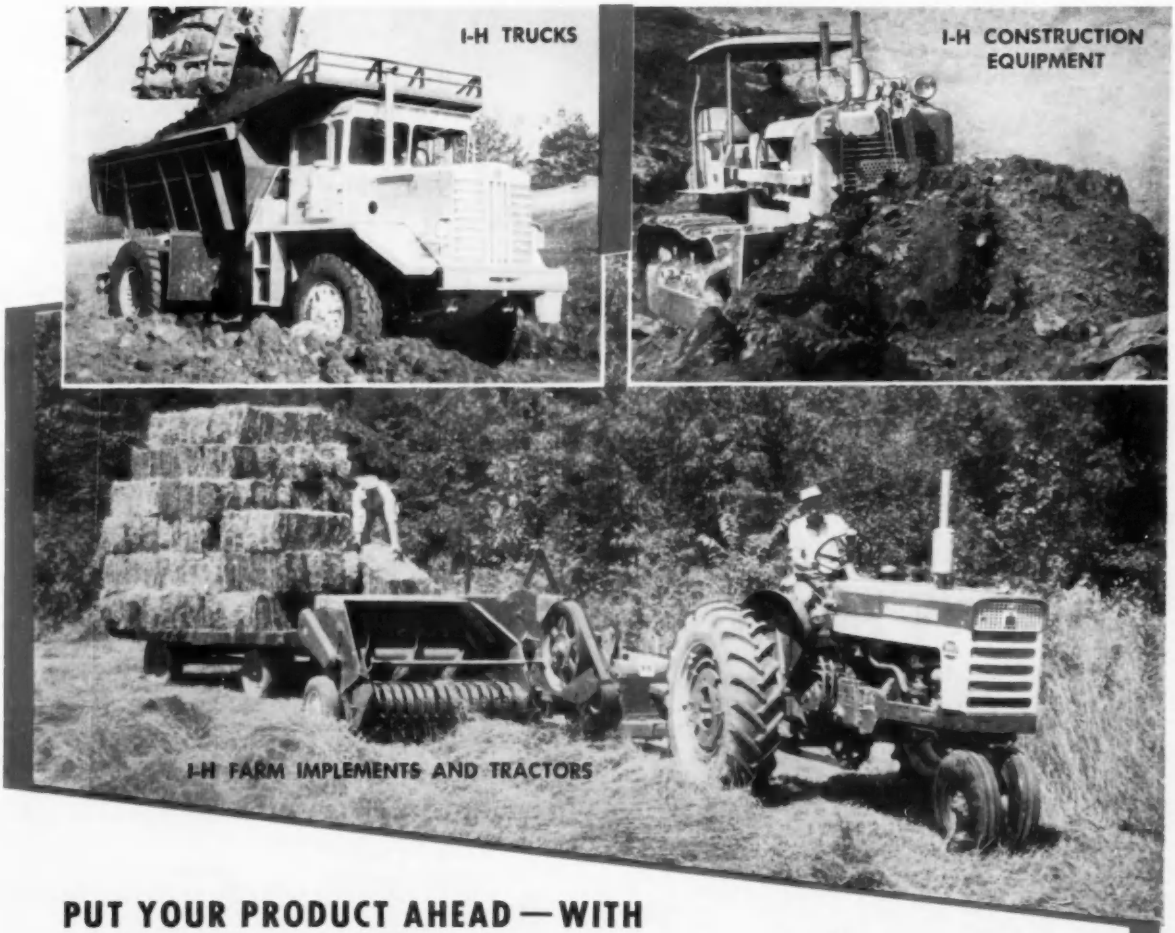
According to Riley, decorative parts on a per pound basis are among the most expensive components of a motor car. This stems from the relatively high price of basic materials as well as the fact that the finished parts do not often lend themselves to fabrication by automated methods. Too, the finishing processes of plating and painting also require many hand operations.

Selection of materials is governed by the form of the part, final finish, structural requirements, as well as environment. Austenitic and ferritic stainless steels, low carbon steel, and aluminum in sheet or strip form are employed for roll-formed sections and stampings. Zinc, aluminum, copper alloys, plastics, and rubber are used to produce cast, molded, forged, machined, or extruded items. Such parts can be plated, painted, anodized, or vacuum metallized.

Historically a lot of changes have taken place in the last 10 years. Door locks have changed from the simple slide bolt type, consisting of 28 parts, to a complex around the

On these rugged products by INTERNATIONAL HARVESTER

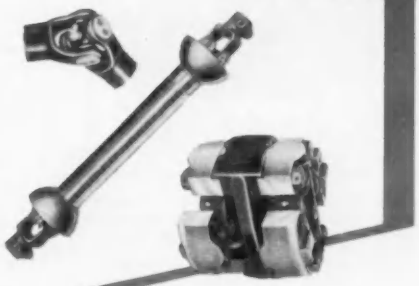
Blood Brothers Universals deliver dependable power



PUT YOUR PRODUCT AHEAD—WITH ROCKWELL-STANDARD COMPONENTS

On all these major-product lines, International Harvester uses Blood Brothers Universal Joints. In rigorous daily service, they've proved outstanding ability to *deliver power dependably*. And for I-H, that means customer good-will insurance!

If you build construction, farm or transportation equipment, investigate these Rockwell-Standard components. Write or call for specific data—or request Bulletin 557 describing Blood Brothers Universal Joints.



UNIVERSAL JOINTS AND DRIVE LINE ASSEMBLIES

ROCKWELL-STANDARD CORPORATION

ROCKWELL R STANDARD BB UNIVERSAL JOINTS

Blood Brothers Universal Joints

ALLEGAN, MICHIGAN

glass type having 50 parts and operated electrically. Seat adjusters have changed from a two-direction manual type to a power-operated six-way type. The simple window regulators have given way to intricate power-operated mechanisms consisting of 46 parts, moving larger windows in a rocking motion. Exterior moldings have changed from bent rolled sections to compound curved stampings with tapered sections. New materials such as aluminum and plastics have been introduced to accentuate styling. It is plain to see why greater coordination is needed among stylists, engineers, and manufacturing departments.

In a paper titled "Dum-Dum Comes of Age" D. L. Jones, Ford Motor Co., described the latest developments in silencing and sealing materials, leading to the adoption of a new water-petroleum solvent blended deadener. It can be sprayed with facility anywhere, on any kind of surface, subjected to a variety of oven bake temperatures, and still produce a well damped panel. This material is replacing all other deadeners in use at Ford.

Before placing the material in production it was first tested under actual manufacturing conditions on Lincoln cars at the Wixom plant. It was sprayed onto floor pans and over the entire underbody as an undercoating. The areas were easily sprayed without difficulty from the standpoint of flow, sprayback, fogging, etc. It functioned so well that the management insisted on continued use.

Another new Ford development is a pumpable expanding sealer which has been used successfully in sealing cowl plenum chambers and many other seams difficult to seal after assembly. This uncured rubber is applied in a viscous state before painting. Oven heat expands and cures the rubber into a sponge rubber consistency, actual volume increase being about 150 per cent.

Such an expanding material appeals to the imagination since rather large gaps can be adequately filled. On the other hand it has some drawbacks. Joints to be sealed must be designed correctly; the cost of the material is

high; and it has poor storage characteristics. Recent improvements have minimized the danger of solidification during storage in hot weather; and as usage goes up cost should come down. This leaves one major problem—design. For best results the opening must be closed on at least three sides. This means, in general, that designers must become conscious of sealing problems. Proper attention to details will make the job easier and less expensive.

While other speakers emphasized the need for close cooperation between the various departments, S. L. Terry, Chrysler Corp., touched on the importance of corporate planning in synthesizing the planning of individual departments into a unified corporate plan combining the best thinking from all affected areas.

Corporate planning does not delve into creative areas. Instead, its function is to point out and resolve differences in proposals from the various specialized groups until a single unified plan is evolved that is agreeable to all concerned.

Planning is complicated by the increase in product complexity coupled with the trend to yearly changes in design. Costs have gone up proportionately. For example, when Chrysler Corp. was launched in 1924, the investment in tooling was $15 million. The tooling cost for launching the 1959 models, on the other hand, rose to $150 million. Another complication comes from the operation of regional assembly plants. This requires earlier release dates, more rigid control of changes, and better and more complete communications.

Planning at Chrysler is vitally concerned with lead time. Currently, it takes four years of scheduled work to progress from the initial concept stage of a new car to volume production. Because of this, most activities are actively engaged in working on models for at least two different years and sometimes for three different years.

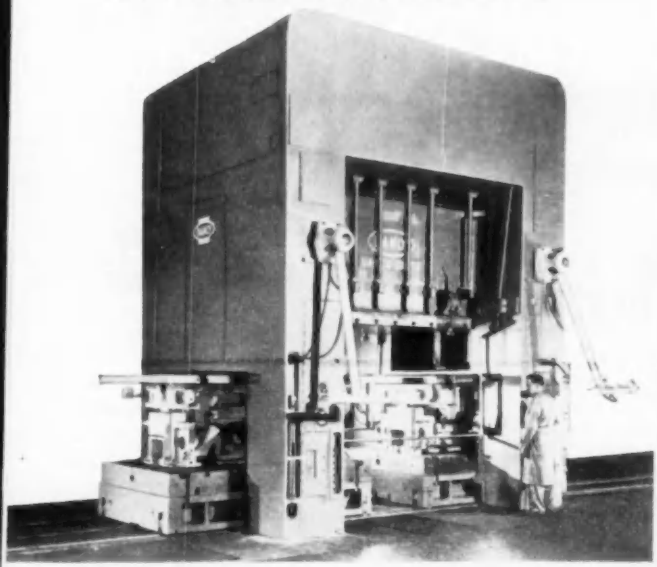
The Master Timing Schedule is the means of coordinating work in all areas to arrive at a completely tooled and tested car design in time for a public announcement date. Every effort is made to compress the schedule as much as possible. The actual dates are arrived at by mutual compromises between the affected parties. When these compromises have been made and dates established, the completed Master Timing Schedule is endorsed by Top Management and set up as the operating schedule for the corporation for that particular program. In each affected area detailed timing schedules are then established which set up internal control dates, emphasizing those dates on which it is necessary to get information from other areas. It is the function of Product Planning to reconcile promise dates and requirement dates among the various working groups in order to set up the original Master Timing Schedule. Furthermore, Product Planning monitors adherence to that schedule, pointing up deviations as they occur with the reasons therefor, and working out corrections and improvements as they come along.

A similar system is followed in

DANLY®

The Leading Supplier to the Stamping Industry

in PRESSES



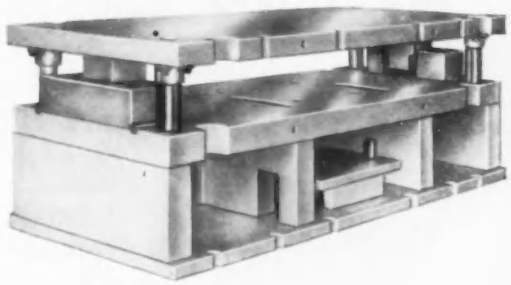
The report of the Business and Defense Service Administration shows that Danly led all producers of prr ses during 1957. Industry made Danly the first choice because you get lower operating costs with a Danly Press—you can depend on it! Each press is engineered to turn out more accurate stampings . . . to produce more units per shift . . . and to reduce profit-eating maintenance and spare parts inventories.

There are many new developments you should know about, such as the Quick Die Change feature available on all Straight Side Presses . . . single, double and triple action . . . the modern high-production Autofeeds . . . and the completely modern line of Open Back Inclinable presses just introduced. See how Danly can help you reduce costs and give your products the stamp of leadership!

Shown above: *Danly Quick Die Change Press.* Die at right leaves press as one at left moves into operating position. Time for the change: 6 minutes. Now operating in plant of French auto manufacturer.

Write for Quick Die Change Press Bulletin that contains drawings and complete description of these new presses.

in DIE SETS and Die Makers' Supplies



Danly is now working on its fifth million in die set production. Included in this production are many die sets for the automotive industry—that are working in that industry in its multi-million car production of today.

In every instance, Danly can meet your most exacting diemaking specifications with a die set—standard or special. Since pioneering the first mass-produced precision die sets 36 years ago, Danly has continuously developed new production, inspection and distribution methods to serve you better.

Today, there's the new Danly Die Set with Demountable Bushings being assembled in a factory branch or distributor assembly plant near you. It is your fast, convenient source for toolroom and pressroom supplies that bear the stamp of leadership. Danly facilities for special Die Set manufacture are also improved and expanded.

Shown above: a special die set that Danly recently built for a major automotive manufacturer. It will finally be used in a South American plant of the company. It is equipped with Danly Demountable Bosses, above, and Bushings, below.

Send for money-saving facts. Write us and your distributor or branch will give you helpful information on Danly Die Sets.

DANLY MACHINE SPECIALTIES, INC.

DANLY®

Circle 170 on Inquiry Card for more data

2100 S. Laramie Avenue, Chicago 50, Illinois

the determination of what the product will be for a future model year. When the Timing Schedule for a new model indicates the need, a product proposal in booklet form is made by the Engineering Division. Feeding into this product proposal are the product requests from each of the various car Divisions, Styling, Engineering, and Sales. Through Product Planning Committee action, product proposals from all of these sources are melded into a single proposal for the cars for that particular year. This single proposal then is published in what is called a Profile Book. The Profile Book, like the Master Timing Schedule, is simply a means of communication between the various groups, each of which has its own particular point of view. Additions, deletions and changes in the Profile are then handled by means of Product Planning Letters procedurally created for that purpose.

Imagination in aluminum also was featured in the display by Reynolds Metals. They showed some intriguing designs of bumpers and bumper-grille combinations in integrated form. Integrated design also was stressed in some handsome renderings of hoods and deck lids, as well as in an aluminum wheel combining the hub and brake drum. Such creative ideas should be helpful to stylists and designers in planning the product of the near future.

Delrin, the new idea in plastic formulations, introduced by duPont some time ago, was presented at the meeting in a paper by Dr. H. H. Goodman and W. J. Scarborough as a new material for body designers. ■

Demand for Economy Affects Engine Trends

(*Continued from page* 61)

independent researchers are working on various types of unorthodox engine designs.

At the present writing the gas turbine and free piston engine appear to be something well out in the future. There still remain problems of design, and materials, and gas tank economy before these powerplants become a commercial reality. Too, there is a serious problem of manufacturing cost that will have to be resolved before these machines can be considered for mass production.

Meanwhile, the reciprocating internal combustion engine appears to have a lot of vitality and promise. Designers are attacking problems of improved combustion, improved structures of greater rigidity, and lighter weight. We are getting much more bhp/cu in. out of new engine designs than ever before. And as the old, old reciprocating engine is refined and improved in mechanical and thermal efficiency, the margin of superiority of competing types becomes progressively reduced. We are indeed in the midst of the usual vicious circle that confronts any competitor.

Not so long ago fuel injection was given a terrific boost and it looked for a while as if it would

(*Turn to page* 131, *please*)

There is no substitute for stainless steel
in automobiles

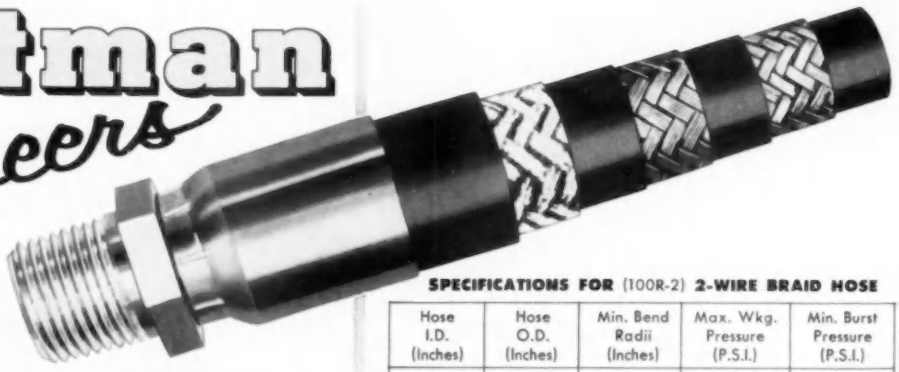
No other material is as bright, strong and resistant to rust and wear as Stainless Steel. It gives every car the clean, exciting beauty that sells in the showroom and re-sells on the used car lot. Look for *Stainless Steel* on your new automobile.

Specify McLouth high quality sheet and strip Stainless Steel. McLouth Steel Corporation, Detroit 17, Michigan.

McLOUTH STAINLESS STEEL

Eastman

engineers the way



TO HIGHER PRESSURES

Eastman engineering is making possible ever-increasing advances in hydraulic pressures through:

- Couplings designed to exceed minimum *burst* pressure —four times actual working pressure.
- Hydraulic application of couplings to hose, assuring maximum grip—within specified hose tolerance.
- Maximum orifice—designed to improve fluid flow, reduce friction and increase power delivery.
- More rigid testing of completed assemblies to reveal additional opportunities for improvement.

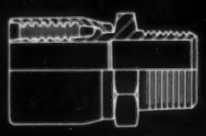
Let Eastman engineers help you increase the "power-performance ratio" of your product to improve *your* competitive position in *your* field.

SPECIFICATIONS FOR (100R-2) 2-WIRE BRAID HOSE

Hose I.D. (Inches)	Hose O.D. (Inches)	Min. Bend Radii (Inches)	Max. Wkg. Pressure (P.S.I.)	Min. Burst Pressure (P.S.I.)
¼	11/64	4	5000	20000
3/8	27/32	5	4000	16000
½	31/32	7	3500	14000
¾	1 ¼	9½	2250	9000
1	1 25/64	9½	1875	7500
1 ¼	2	16	1625	6500
1 ½	2 ¼	20	1250	5000
2	2 ¾	22	1125	4500

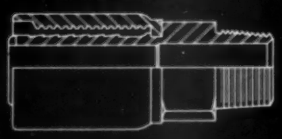
PERMANENTLY ATTACHED COUPLINGS

For 2-wire braid hose. Offers maximum coupling strength, strong hose attachment and improved orifice for rapid, friction-free fluid flow. For working pressures up to 5000 psi. See Pages 10 and 11.



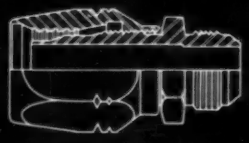
HIGH PRESSURE COUPLINGS

For EXTREME high pressures up to 7000 psi working pressure. Eastman engineered for greater power delivery and performance. For specifications and sizes, send for New Eastman Bulletin 200, below.



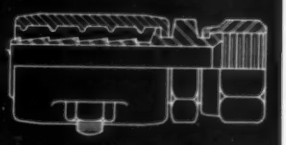
2-PIECE REUSABLE COUPLINGS

For 2-wire high pressure hose up to 5000 psi working pressure. Increases serviceability of your equipment through easy replacement in the field. See new Bulletin for complete details.



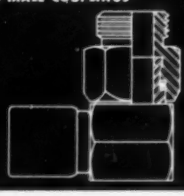
CLAMP TYPE COUPLINGS

Accurate machining assures alternate positioning of clamp ribs between each barb of insert—creating exclusive Inter-Lock grip—available to you only through Eastman. Pages 14 and 15.



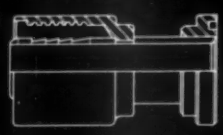
SWIVEL "O" RING MALE COUPLINGS

Permits easy assembly in close quarters, easy positioning of hose in 45° and 90° angles. Economical, reduces number of threaded connections. Dimensional drawings, sizes, and specifications in new Bulletin.



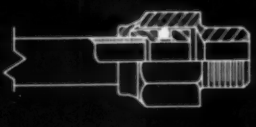
FLANGE HEAD COUPLINGS

Offer advantages of permanent hose attachment plus Split Flange Head Couplings with 0° to 90° stems. Economy plus user convenience. Specifications and sizes listed in new Bulletin.



TUBING ASSEMBLIES

Swivel Male "O" Ring Tube Nut used on tubing assemblies. Eastman offers formed tubing with beaded or flared ends—to your requirements. Specifications and sizes on Page 30.



Eastman

first in the field

MANUFACTURING COMPANY

Dept. AI-11, MANITOWOC, WISCONSIN

Write FOR YOUR NEW BOOK— WITH THAT NEW LOOK!

- A NEW Service Concept.
- A NEW High in Convenience.
- A NEW Ease in Specifying— according to **your** pressure requirements.

SAFEGUARDING AMERICA'S LIFELINES OF MOBILE POWER

(*Continued from page* 128)

displace the conventional induction system. For many good reasons fuel injection furor has simmered down. As we mentioned earlier, in 1959 it is found only on Chevrolet engines.

That does not imply that fuel injection is out of the picture. There are a number of factors involved but by far the most vital is the matter of cost. In another year cost would not have been a problem. In 1959 it definitely is. Fuel injection still looms as an important development but it can make real gains only when costs can be brought down to a reasonable level. As a starting point, it should not exceed the cost of the two four-barrel or the three two-barrel carburetor systems.

The centrifugal supercharger too had a brief moment of glory—then disappeared. Inventive genius is bound to develop many new devices and these will be judged rather harshly on realistic grounds before they can become commercial.

If the reciprocating engine continues to predominate, as it promises at this writing, perhaps the next major advance should come in the form of the all-aluminum engine. Everyone in the industry, including the aluminum research organizations, is working on this next phase. Most promising is the work being done in the area of the hypereutectoid aluminum alloys.

The advent of the aluminum engine has been delayed for a long time due to the complication of wet or dry cylinder liners, seat inserts, etc. If high silicon alloys can be developed to the point where liners no longer are necessary the major bar will have been cleared. A lot of people are engaged in making this result come true.

Finally, it may be noted that our whole concept of engine design may have to go by the board if chassis design turns to either a front drive or a rear engine location. In that event, the engine as we know it may lose its identity and become part of an integral structure that contains the engine, transmission, and differential. This could happen within the near future, judging by current events. ■

MACHINERY NEWS

(*Continued from page* 68)

Kearney & Trecker skin mills, and three Bendix-controlled K & T profile mills.

He cited records showing considerable cost savings, as well as reduced lead times. For example, on a B-52G lower wing panel, the first-unit time on a tracer-controlled spar mill was 1070 man-hours. By the 14th unit, the time had leveled off at 350 man-hours. On the 15th unit, the part was transferred to a numerically-controlled skin mill. Here the first-unit time was 300 man-hours; leveling off by the fifth unit thereafter to below 100 man-hours.

On lead time reduction—four parts of a structural test specimen, duplicating each other within ±0.005 in., were required quickly. Time for tooling and building by conventional methods was estimated to be four weeks. The parts were programmed and machined on a numerically-controlled profile mill and delivered, with an accuracy of ±0.003 in., in four working days.

* * *

Latest Figures on Machine Tool Sales

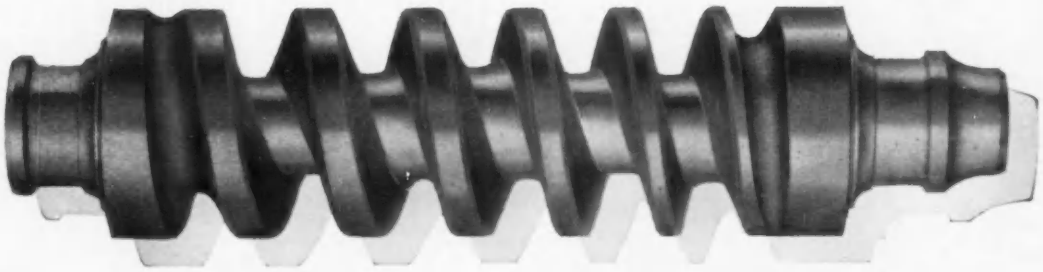
Latest statistics from the National Machine Tool Builders' Association show that net new orders for forming-type machine tools amounted to $8 million in September. While the business in August was $9.05 million, monthly sales during the first nine months of this year averaged $7 million.

Metal-cutting-type orders in September are valued at $20 million net—higher than August's $19.25 million, but less than the nine months' average of $22.17 million.

Overall, thus far this year net new *orders* for metal-cutting-type machine tools total $199.55 million. The comparable figure for the first three quarters of 1957 is $445 million. *Shipments* of this category total $319.1 million for 1958—compared to $679.1 million for nine months of 1957.

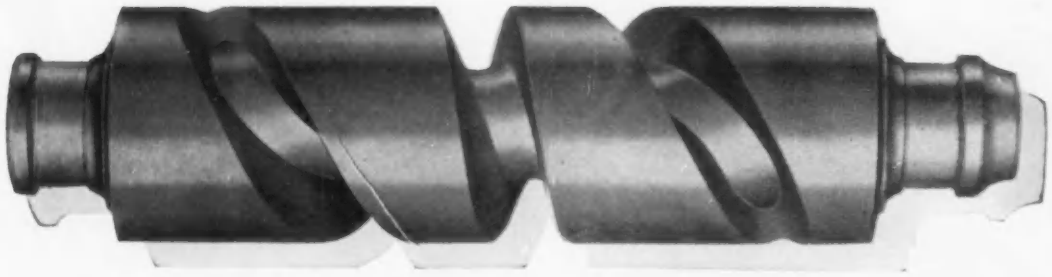
Net new *orders* for forming-type machine tools totaled $63.05 million, and *shipments* had a value of $82 million, during the first nine months of this year. ■

Tale of Two Steering Cams



Constant ratio 22:22:22 . . . 22 to 1 ratio for cornering and 22 to 1 for straight-ahead driving . . . 5 turns of steering wheel from lock to lock.

Variable ratio 12:20:12 . . . 12 to 1 ratio for cornering and 20 to 1 for straight-ahead handling . . . 3 turns of wheel from lock to lock.



. . . Constant Ratio and Variable Ratio

Ross

▶ Yes, these two cams tell a Ross engineering story of *alert steering response* and *greater maneuverability* for vehicles of many different types:

Passenger Cars	Farm Machinery
Trucks, Buses	Industrial Equipment

▶ The two vastly different cams also help dramatize the fact that Ross provides a gear for every steering need, power or manual, variable or constant ratio. Variable ratio steering was originated and developed by Ross.

▶ Ross invites discussion of *any* steering problem.

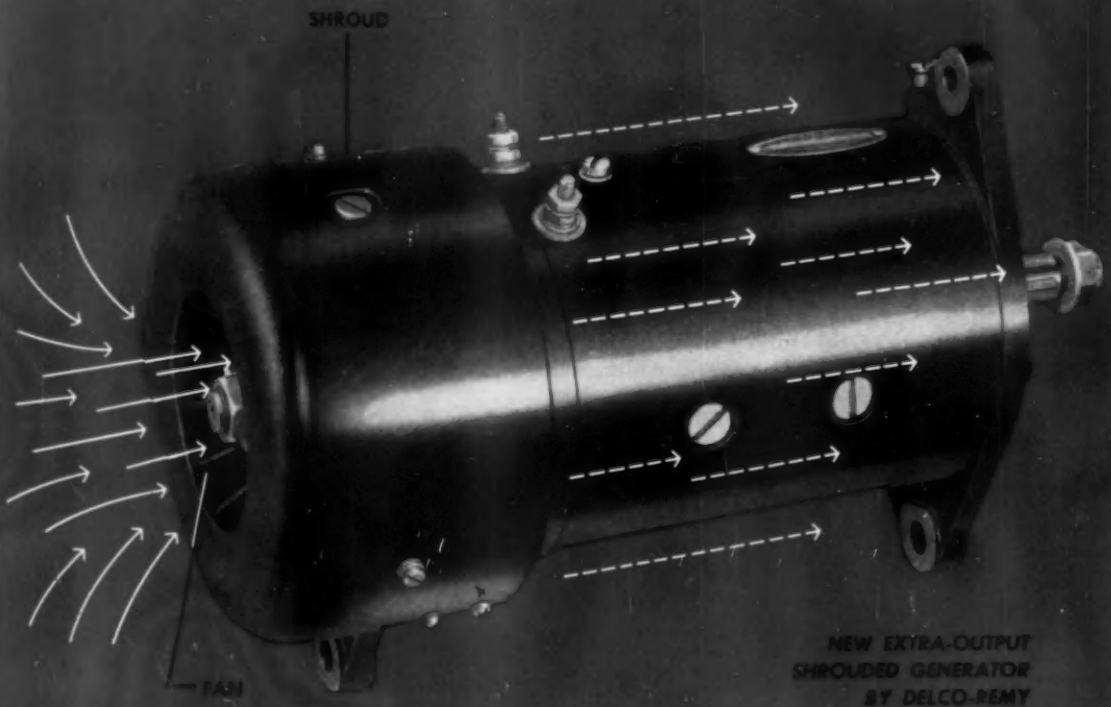
STEERING

ROSS GEAR AND TOOL COMPANY, INC. • LAFAYETTE, INDIANA

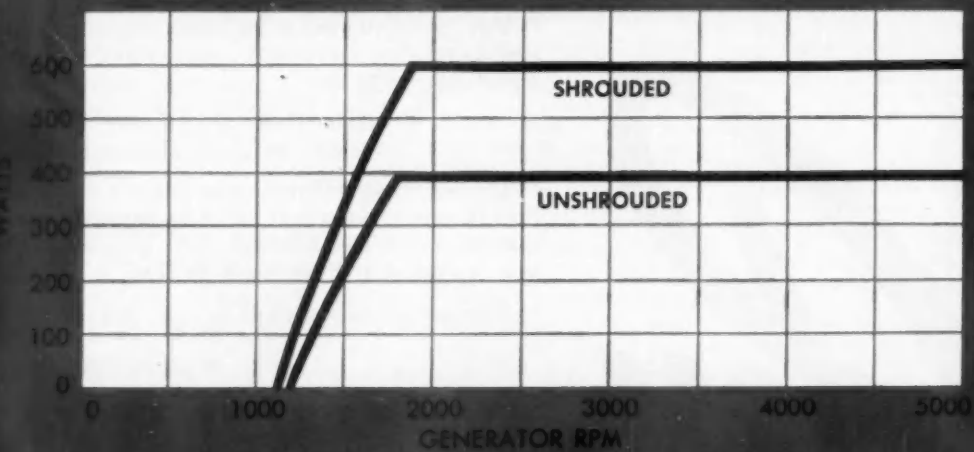
Gemmer Division • Detroit

Circle 176 on Inquiry Card for more data

PROGRESSIVE ENGINEERING MAKES THE DIFFERENCE



NEW EXTRA-OUTPUT SHROUDED GENERATOR BY DELCO-REMY



COMPARABLE OUTPUTS OF ENCLOSED GENERATORS WITH AND WITHOUT SHROUD

NEW DELCO-REMY TOTALLY ENCLOSED GENERATORS OFFER 50% MORE OUTPUT WITHOUT INCREASE IN SIZE

Delco-Remy's new, totally enclosed shrouded generators offer up to *50% more* output than former enclosed models of this size. They are especially designed for construction vehicles and off-the-road equipment subject to extremes of dust and moisture, or corrosive materials. Because they are totally enclosed, they are *splash-proof* and *dust-proof*.

Key feature of the new units is a high-efficiency fan mounted at the commutator end in a compact, formed steel shroud. The shroud-controlled air blast travels closely along the generator frame where it produces rapid and effective cooling . . . makes possible up to *50% more output*, without the added cost of increased frame size.

For every kind of heavy-duty operation, Delco-Remy generators provide greater power and reliability with long life. Be sure to specify Delco-Remy shrouded generators—where required—for your new equipment. Readily available in 6-, 12-, and 24-volt models for replacement application on present equipment through the United Motors System.

DELCO-REMY • DIVISION OF GENERAL MOTORS • ANDERSON, INDIANA

GM GENERAL MOTORS

GENERAL MOTORS LEADS THE WAY—STARTING WITH

Delco-Remy

ELECTRICAL SYSTEMS

Engine and Brake Developments

SAE Transportation and Diesel Engine Meetings

(*Continued from page* 54)

With respect to fuels, Ordnance has in mind any fuel from 83/91 octane down to the middle distillate range (governed by viscosity and pour point under the applicable ambient temperature). The engine should not only develop full output (proportional only to the specific heat content of the fuel used) on any one of these fuels, but also must be capable of operation on any mixture of them—and without manual adjustment. It must also be capable of starting and operating in temperatures from —25 to 115 F.

Ordnance objective is for an engine weighing no more than six pounds per horsepower for the engine-cooling package. While extensive investigation has proven that the principle is practical, Ordnance feels all of the multifuel engines that have been developed to date are too large and too heavy. It was stated the most advanced development weighed 10 lb per horsepower; although one builder said his engine weighed 8.5/9.0 lb per horsepower.

Results of the very considerable development work that has been conducted by Ordnance and engine makers were reported in detail at the meeting. These included studies on GMC Model 71, the Continental Hypercycle, International Harvester, Mack Truck, Deutz, Buda, Waukesha, and Harnischfeger engines.

Molded Fiber Glass Truck Cab

The merits of molded fiber-glass-reinforced plastic in automotive applications, with particular emphasis on a brand new truck cab design, were expounded at one of the sessions. Speakers were B. C. Harris, White Motor Co.; R. A. Terry, Creative Industries of Detroit; and J. Hammond, Molded Fiber Glass Body Co.

Said to be the first complete molded-fiber-glass body assembly in volume production, the new White truck cab represents one-piece construction. It is made up of 36 molded parts, bonded together. Of the COE type, it tilts forward for access to powerplant. Width is 96 in., and length from bumper to rear of outside of cab is 50 in.

Door design is generally like that on automobiles. Anodized aluminum extrusions are used in the glass areas. The front windshield is made up of two large sections, each of which has glass extending downward into the front body corners. Underbody, including engine enclosure, is molded in one piece.

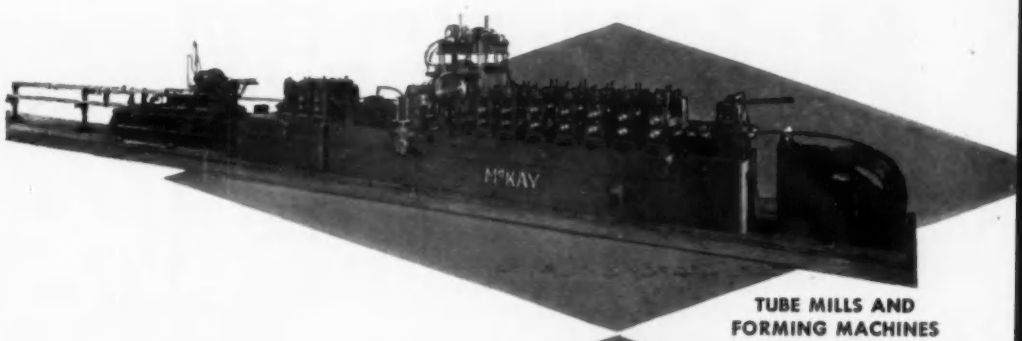
Most body sections are 0.100 in. thick, considered to be the equivalent of 20-gage steel but weighing 40 per cent less. Reinforced sections have 0.200 in. thickness.

Molding is with matched metal dies, employing a hydraulic press. Temperature used is in the range of 225/275 F and pressure 100/150 psi on the molded surfaces.

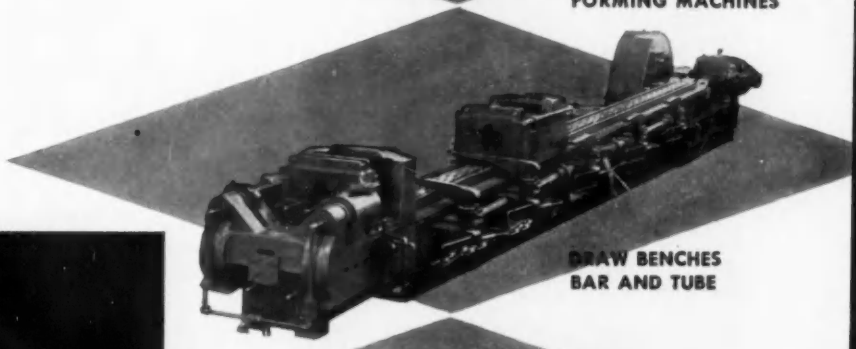
The same polyester resin in the base material is used for bonding the molded sections together in the assembly operation. A catalyst is added for curing at room temperatures. Mating surfaces are roughed up, bonding mixture applied, and parts clamped in position. Time of bonding can be controlled by the catalyst or application of heat. Strength of the bonded joint was said to be just as strong as the base material.

For mounting, an underframe is used to support the cab. This platform is of high tensile aluminum extrusions, bolted to floor and front and rear panels of cab at 49 different places. The cross member in front of underframe is tubular to give torsional stability. It is also used as a radiator surge tank.

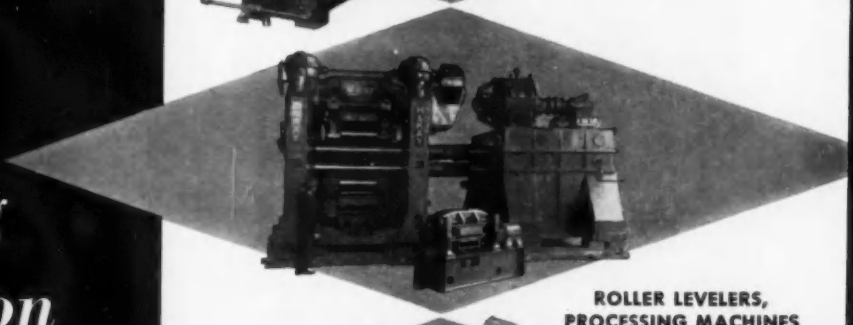
Mr. Harris admitted that the cost of the molded fiber glass cab was higher—the process takes a longer time—but explained that its application is in a premium type vehicle where the anticipated market is relatively small. On the other hand, cost for tooling is much lower. One of the speakers estimated that tooling cost for the cab is about one-fifth to one-sixth that which would have been required for steel. ■



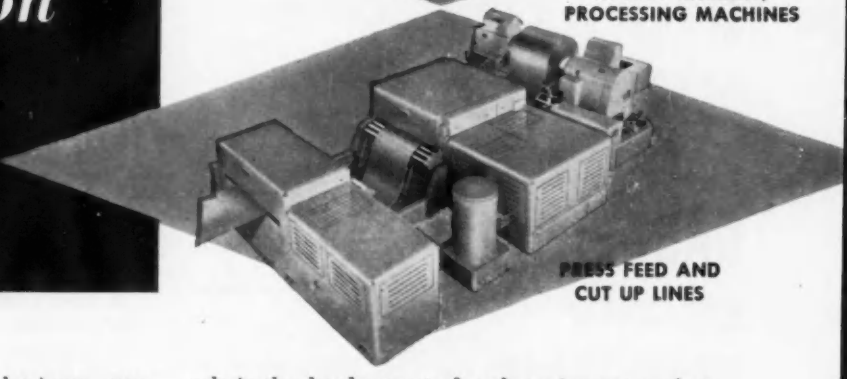
TUBE MILLS AND
FORMING MACHINES



DRAW BENCHES
BAR AND TUBE



ROLLER LEVELERS,
PROCESSING MACHINES



PRESS FEED AND
CUT UP LINES

Metal working Automation in action...

If you're in the metal working business, you should be acquainted with McKay *automated* lines available for many metal working operations.

McKay pioneered and has played a leading role in the development of such equipment as that pictured on this page.

Basic McKay designs can be modified, or special machines developed to meet specific requirements.

THE McKAY MACHINE CO., YOUNGSTOWN, OHIO

SPECIAL
MACHINERY

Circle 179 on Inquiry Card for more data

McK

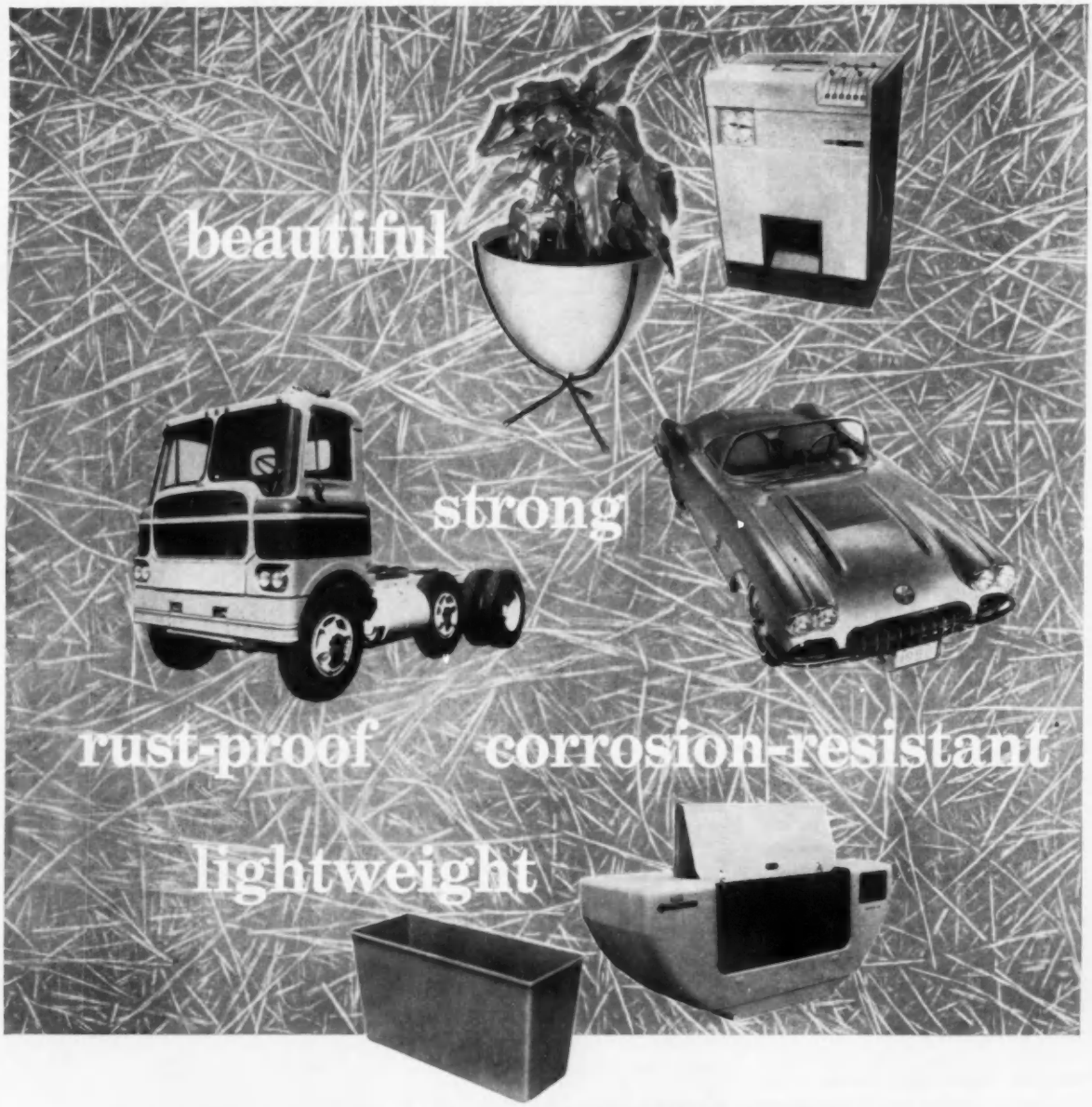
NEW DEVELOPMENTS

(*Continued from page 75*)

Glass Bath Furnace

The Bal-Tate glass bath furnace can be used for extrusions, rolling, forgings, forming, and soaking pits.

To start operation common glass scraps are loaded into the rotating furnace. The scraps melt and flow down to cover the bottom of the furnace, forming a layer nearly four inches deep. The billets are preheated to about 1110 F by the waste gases exhausted from the furnace and are then charged in the furnace with their horizontal axis parallel to the rotation axis of the furnace. Because of the furnace rotation, the billets roll down into the melted glass, which completely descales the billet surfaces by converting all oxides into iron silicate, and then forms a protecting layer which, being gas-proof, prevents any further oxidation of the steel. ■



MOLDED FIBER GLASS, *of course!*

MOLDED FIBER GLASS is the exclusive trade name for fiberglass reinforced plastic custom molded in matched metal dies by the affiliated Molded Fiber Glass Companies.

More and more of the largest, most important manufacturers in the United States are buying MOLDED FIBER GLASS parts to solve their cost and production problems. (MOLDED FIBER GLASS can be molded to almost any shape.)

Perhaps you, too, can use MOLDED FIBER GLASS parts to make a better product at less cost. Write today for information.

(The above MOLDED FIBER GLASS products are: planter, time clock housing, truck cab, sports car body, wastebasket, aircraft luggage container.)

GREATEST NAME MOLDED FIBER GLASS IN REINFORCED PLASTICS

MOLDED FIBER GLASS COMPANY
MOLDED FIBER GLASS BODY COMPANY
4611 Benefit Avenue, Ashtabula, Ohio

Circle 183 on Inquiry Card for more data

Unbiased recommendations

FRICTION or FLUID DRIVES

Manual, Air or Hydraulic Operation

To couple an engine or motor to the load, one of the following may be used: a friction clutch, fluid coupling, single-stage torque converter or a three-stage torque converter. Twin Disc can furnish you an unbiased recommendation as to which is the best selection under any given set of circumstances—for Twin Disc offers *all four types of drives.*

No other company builds the diversified line manufactured by Twin Disc. Industrial clutches are offered from 2½ to 36 inches in diameter. Designed to run wet (in oil) or dry, these clutches can be actuated mechanically, hydraulically or with air.

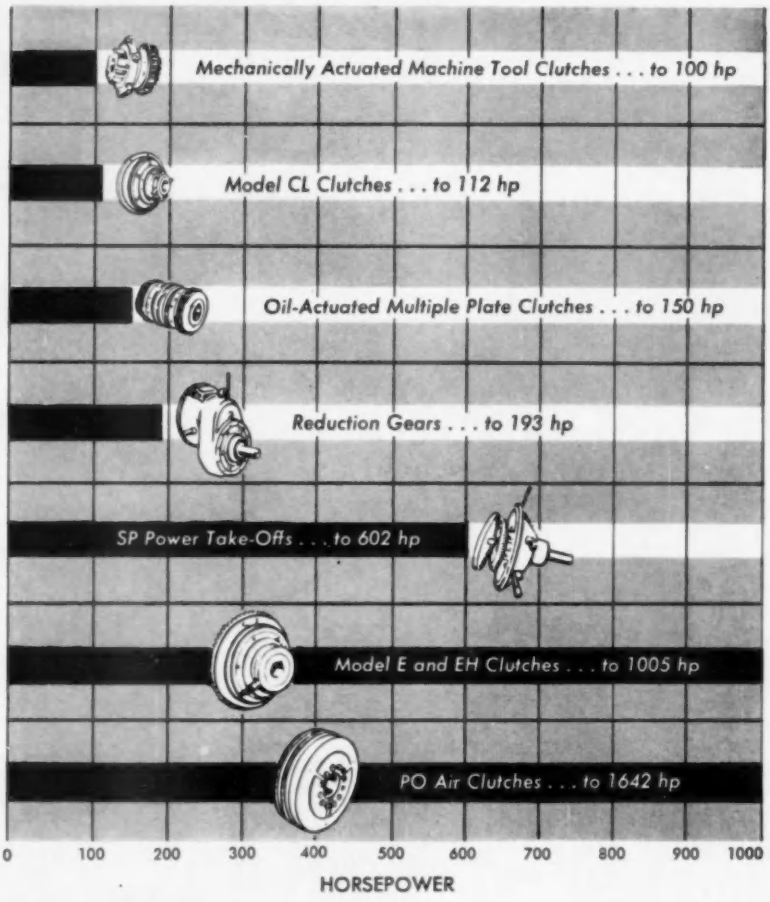
When a fluid drive is necessary or preferable, Twin Disc can recommend just the right one. Twin Disc offers fluid couplings with 1:1 torque ratio . . . single-stage torque converters with up to 3:1 torque multiplication . . . *or* three-stage torque converters with torque ratios up to 6:1. No other manufacturer builds both three-stage and single-stage torque converters . . . no other manufacturer can offer *all three types of industrial fluid drives!*

Whatever drive—friction or fluid—is most appropriate for your own particular application, you'll find it in the Twin Disc line. Write for complete information.

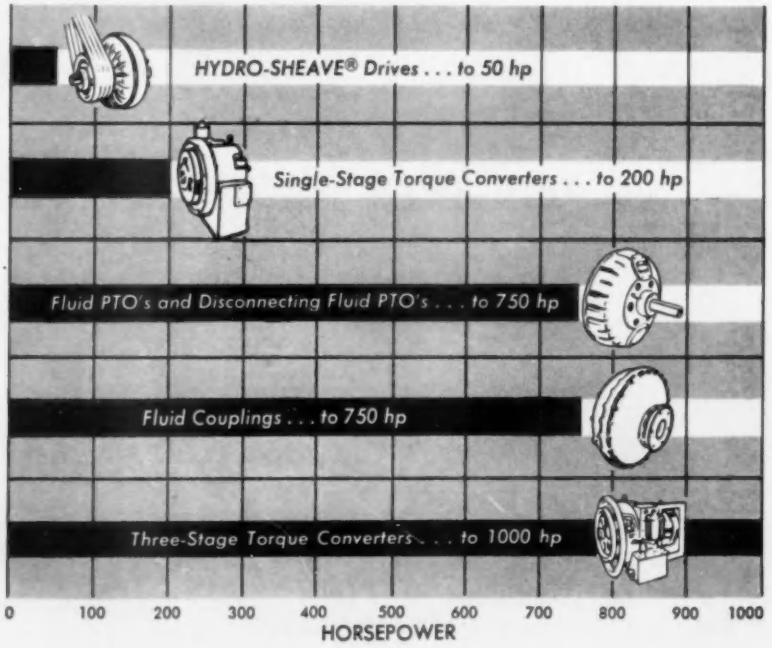
TWIN DISC
CLUTCHES AND HYDRAULIC DRIVES

TWIN DISC CLUTCH COMPANY
Racine, Wisconsin
Hydraulic Division, Rockford, Illinois

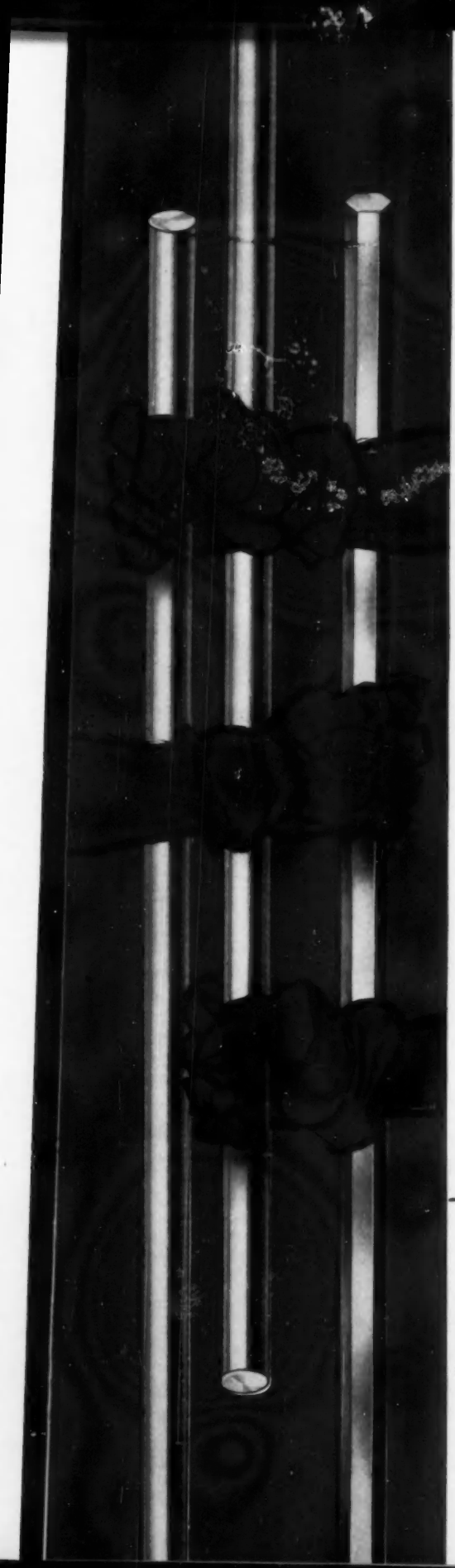
FRICTION DRIVES



FLUID DRIVES



Circle 184 on Inquiry Card for more data



An announcement of interest to manufacturers of steel parts

Improvements in today's STRESSPROOF® STEEL BARS WITH COPPER

1 **100,000 PSI YIELD STRENGTH** in all sizes . . . without heat treating.

2 **IMPROVED PHYSICAL PROPERTIES...** better fatigue life wearability, and resistance to atmospheric corrosion. Over-all quality is improved.

3 **IMPROVED MACHINABILITY...** STRESSPROOF with copper now machines faster and better than ever. It gives longer tool life, better finish, and more production from a day's run, according to shop production records.

4 **CLOSER TOLERANCES...** Tolerances for rounds have been tightened to meet the need for more precise parts as follows:

¼" to 1½"	Over 1½" to 2½"	Over 2½" to 3⅜"
+.000 −.004	+.000 −.005	+.000 −.006

5 **COMPARED WITH OTHER STEELS, STRESSPROOF COSTS EVEN LESS TODAY...** Also saves machining and heat treat costs, and you get a better quality part. It will pay you to take another look at this improved material.

Your STEEL SERVICE CENTER stocks contain today's STRESSPROOF. It has been produced and shipped over a several months' period.

JUST PUBLISHED! Use this coupon to request your copy of new bulletin, "Improvements in Today's STRESSPROOF Steel Bars."

La Salle STEEL COMPANY

1438 150th Street, Hammond, Indiana

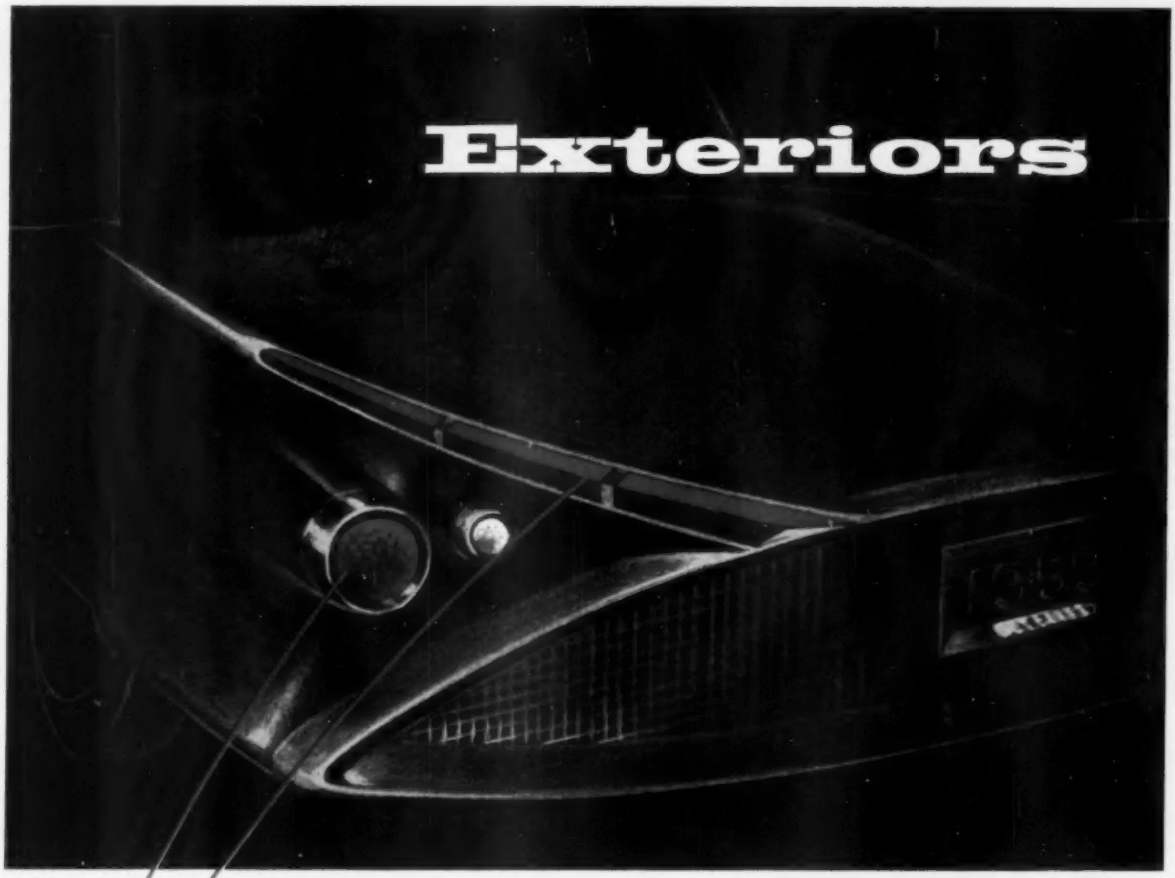
Name_____ Title_____

Company_____

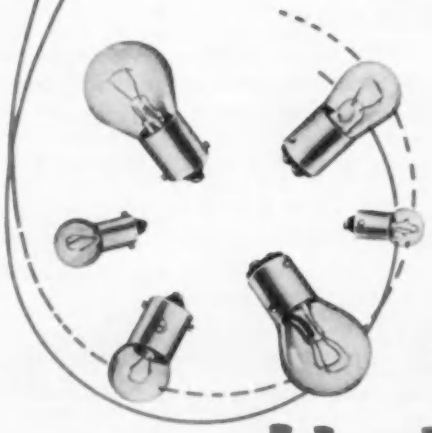
Address_____

City_____ Zone____ State_____

Circle 185 on Inquiry Card for more data



and Interiors too...



Are lit-up with literally dozens of miniature lamps . . . in stop and tail lights, back-up lights, license plate lights, parking lights, turn signals, instrument clusters, radio dials, glove and engine compartments, trunks and other interior lighting. In fact over a hundred *million* lamps will be used in 1959 cars.

New ideas for lamps are found every year and more and more of these lamps come from Hudson. Why? Because automotive buyers who "buy right" know that Hudson lamps can be depended upon for longer more carefree service. Your experience with us will be the same.

Write today for Catalog No. 101.

Hudson LAMP COMPANY
Kearny, New Jersey

Greenlee Transfer Machines can be Reworked to meet Product Changes

The Greenlee "Rearrangeable Unit" concept of transfer machine design is becoming increasingly popular in mass production manufacturing. These machines accommodate recurring changes in product design. Year after year they guard against costly obsolescence . . . they are changed to meet your changing requirements. Get the complete story from Greenlee.

PRODUCTION MACHINERY
GREENLEE

Write for Complete Information, or Phone Rockford, Ill., 3-4881

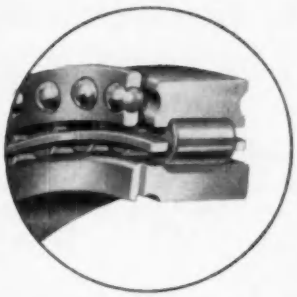
GREENLEE STANDARD AND SPECIAL MACHINES AND TOOLS

- Transfer-Type Processing Machines
- Multiple-Spindle Drilling and Tapping Machines
- Six and Four-Spindle Automatic Bar Machines
- Hydro-Borer Precision Boring Machines
- Core Box Rollover and Draw Machines
- Specialized Woodworking Machines
- Hand Tools for Woodworking
- Tools for Woodworking Machines
- Hydraulic Tools for Electricians, Plumbers, Contractors

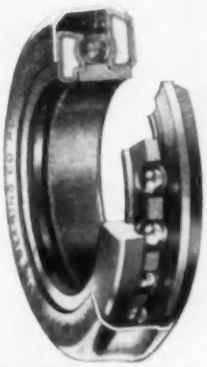
GREENLEE GUARDS AGAINST COSTLY OBSOLESCENCE

GREENLEE BROS. & CO.

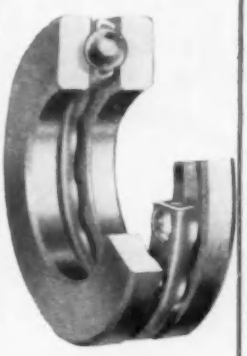
**1761 MASON AVE.
ROCKFORD, ILLINOIS**



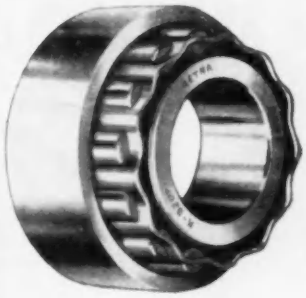
COMBINATION ROLLER AND BALL BEARING



CLUTCH RELEASE BEARING



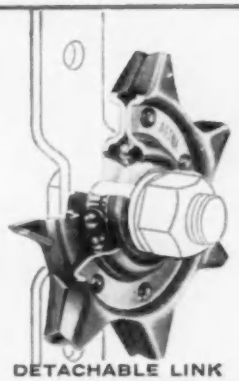
THRUST BEARING



ROLLER BEARING

STANDARD SPROCKET IDLER UNIT

Aetna "Firsts"



DETACHABLE LINK IDLER UNIT

Aetna engineers have that inquiring type of mind which is constantly seeking—constantly asking itself questions—constantly developing new and better ways of doing things.

This creative engineering approach has resulted in an imposing record of Aetna "firsts".

1st to combine cylindrical roller and ball thrust in a single bearing to divorce the load into pure radial and pure thrust for extremely heavy duty service

1st in sales of clutch release bearings for mobile on-and-off the road vehicles—first for more than a quarter-century

1st with a complete line of precision-built thrust bearings to meet practically every load, speed and application requirement

1st to standardize on true crown rollers for all roller bearings to secure the best load distribution of load stresses for far longer service life—permanently assembled in retainers of a type which maintains alignment and correct spacing

1st to combine a roller chain sprocket idler and pre-lubricated ball bearings in a single, compact, easy-to-install single package unit

1st ball bearing detachable link sprocket idler with a full complement of ball bearings, self-contouring seals and sturdy sprocket wheel

Take advantage of this creative engineering talent and Aetna's diversified production facilities. Call your local representative listed in the yellow pages of your Classified Phone Book, or write direct for New 15th Edition Catalog and Engineering Manual.

AETNA BALL AND ROLLER BEARING COMPANY

DIVISION OF PARKERSBURGH-AETNA CORPORATION • 4600 SCHUBERT AVE. • CHICAGO 39, ILL.

IN DETROIT—SAM T. KELLER, 1212 FISHER BUILDING

Aetna **ANTI-FRICTION CONSULTANT TO LEADING ORIGINAL EQUIPMENT MANUFACTURERS SINCE 1916**

TROUBLE FREE *with thousands in use*

WIRE INSERTS PUT CAST IRON WEAR IN TOP RING GROOVE

G and E Wire Insert Piston before machining (left) and after ring grooves are cut (right) showing how the steel wire forms a tough wear-resistant surface on both faces of top ring groove. The ferrous plug molded in the head (for diesel pistons) prevents burning through head and lengthens diesel piston life!

G and E WIRE INSERT PISTONS

(Patented)

★ **Low initial cost—Low cost per mile**

★ **Amazing increase in piston life**

★ **Maintains new engine power and performance**

GET THE G AND E WIRE INSERT STORY—It will save piston money, maintenance costs, and cut operating costs.

With the thousands of G & E "Wire Insert" Pistons in use for periods up to 3 years—a phenomenal record for trouble-free operation has been established. The "Wire Insert" greatly reduces top ring groove wear and increases piston life.

The "Wire Insert" piston design—exclusive with G & E—combines all the advantages of aluminum alloy pistons with the long life of steel in the top ring groove. No noticeable increase in weight—unequalled for rapid heat flow—and at low cost.

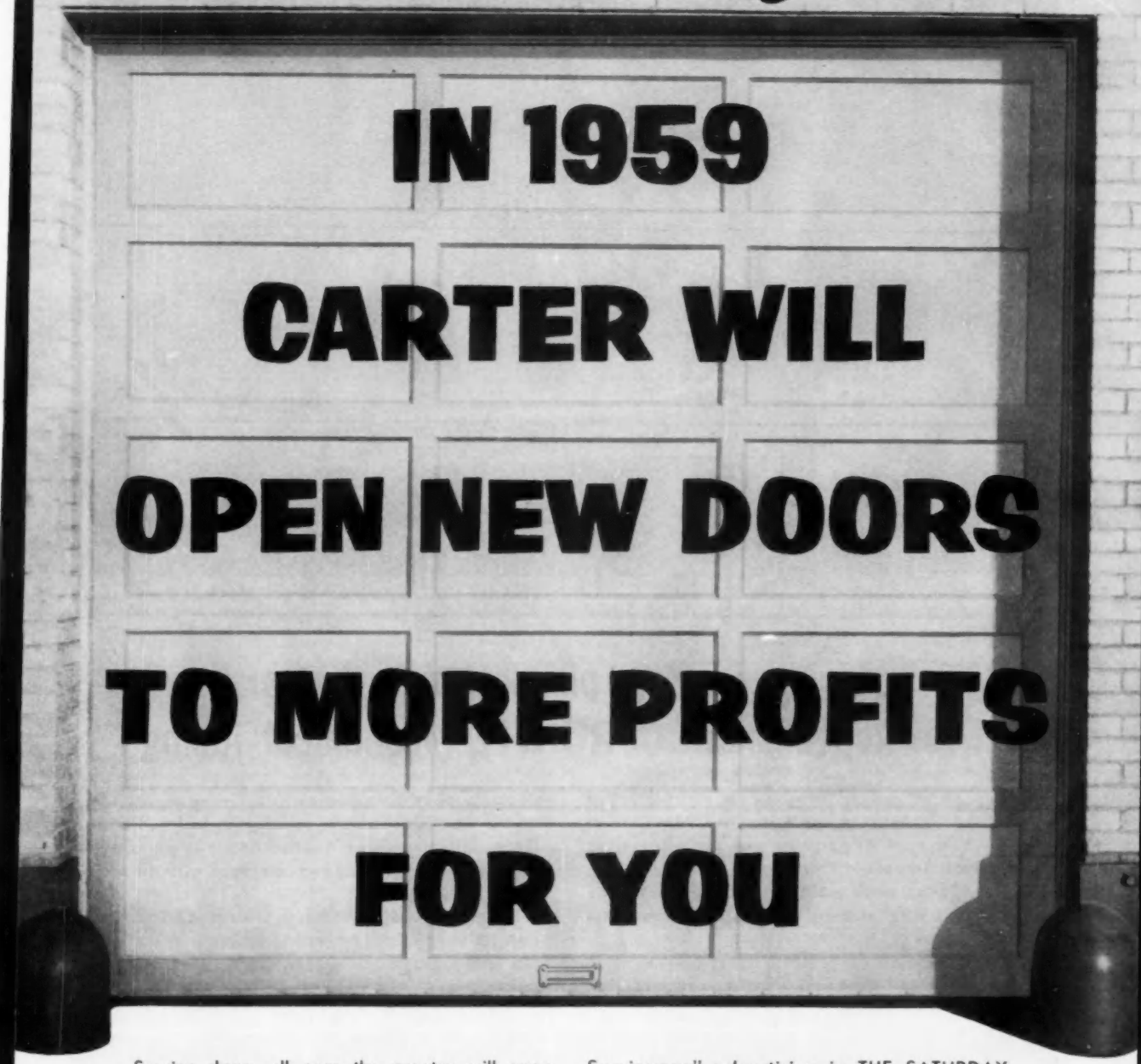
G & E Wire Insert Pistons have a pre-shaped steel wire cast right in the piston wall where the top ring is located. When the grooves are machined, the closely spaced wire surfaces form hard bearing areas on top and bottom faces of the groove. Result—reduced ring land wear, longer piston life at lower cost.

GILLETT AND EATON, INC. 841 DOUGHTY STREET • LAKE CITY, MINN.

G&E

ESTABLISHED 1860

Watch for the Big News!



Service doors all over the country will open extra-wide in '59 to let new profits roll in. Where's the business coming from? From revolutionary new Carter fuel system developments . . . now making final successful "trial runs" in the market, on the road! And that's not all:

Carter's aggressive "Drive the Business to the Serviceman" advertising in THE SATURDAY EVENING POST is making profit history. We plan to make history repeat itself this coming year with powerful new ways to stimulate demand for engine tune-ups.

Your future's fine in '59 . . . with Carter!

C A R T E R C A R B U R E T O R

DIVISION OF acf INDUSTRIES INCORPORATED • ST. LOUIS 7, MISSOURI

Circle 191 on Inquiry Card for more data

Republic ELECTRUNITE Mechanical Tubing is used in four locations across the top of the automatic apparatus that picks up and sets the bowling pins in place. The AMF Automatic Pinspotter is manufactured by the American Machine & Foundry Company, Brooklyn, New York.

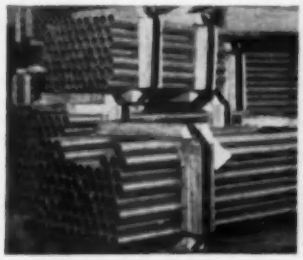
AMF . . . builds a better pinspotter for better bowling with Republic ELECTRUNITE Mechanical Tubing

On the initial order, Republic ELECTRUNITE® Mechanical Tubing saved American Machine & Foundry Company $34,000 in manufacturing their famous AMF Automatic Pinspotter.

AMF had been using tubing that required a boring operation on each end of the tube and centerless grinding on the O.D.

Because Republic's ELECTRUNITE Mechanical Tubing met AMF's O.D. tolerance requirements, the company was able to eliminate the boring and grinding operations. This resulted in a savings of $15,000 in fabricating operations. Another $19,000 was saved on the cost of ELECTRUNITE as compared with the tubing used previously.

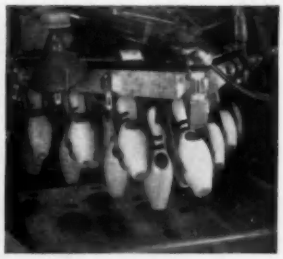
In uniformity and quality, in fabricating, in original costs, Republic's ELECTRUNITE Mechanical Tubing can save you time and money, too! Call your Republic representative, or write today.



Republic ELECTRUNITE Mechanical Tubing is delivered, cut to length, ready for fabricating. ELECTRUNITE Tubing is "electrically welded" resulting in built-in uniformity.

Slots to hold spotting cups in place are cut into ELECTRUNITE Tubing by machine. Concentricity of the ELECTRUNITE assures easy fabrication and smooth mechanical operation.

Drilling and cutting complete, the ELECTRUNITE Tubing is ready for assembly. Lightweight ELECTRUNITE offers uniform wall thickness, strength, ductility for greater serviceability.



Sensitivity in setting off-spot pins is the result of design and engineering, highest quality workmanship, and highest quality materials, such as Republic's ELECTRUNITE Tubing.

REPUBLIC NYLOK® FASTENERS SAFEGUARD PERFORMANCE SPECIFICATIONS. Republic fasteners are used extensively on Gemco Rotary, Reel, and Riding Power Lawn Mowers. Inset shows blade assembly securely locked to engine shaft with Nylok Cap Screw. An added advantage of Republic Nylok Bolts and Cap Screws is their ability to seal against fluid escape when wrenched tight. Nylon pellet in bolt body blocks flow of fluid along helical threaded path. Send for data.

REPUBLIC MANUFACTURERS' COARSE WIRE to meet every production need. Box Binding and Stapling, Brush Handle, Chain, Garment Hanger are only a few of the qualities regularly produced. Large tonnages are shipped to manufacturers of fan guards, wire partitions, concrete reinforcing specialties, plated shelves, racks and grilles, and numerous other products. Republic wire metallurgists are available to help you in solving production problems. Write today.

REPUBLIC HIGH STRENGTH STEEL IMPROVES SERVICE LIFE for many types of equipment. In the bottom of this conveyor, for example, it provides excellent resistance to abrasion and corrosion. Far less frequent replacement is required as compared with a bottom made of ordinary steel. And, its high strength-to-weight ratio allows use of lighter gages. Send for details.

REPUBLIC STEEL

World's Widest Range of Standard Steels and Steel Products

REPUBLIC STEEL CORPORATION
DEPT. AI-6300
1441 REPUBLIC BUILDING • CLEVELAND 1, OHIO

Please send information on the following Republic products:

☐ REPUBLIC ELECTRUNITE Mechanical Tubing
☐ Republic Manufacturers' Wire ☐ High Strength Steel
☐ NYLOK Bolts and Cap Screws

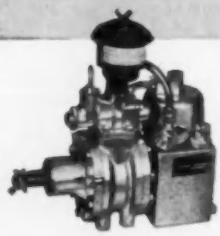
Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

Rigid quality control
in manufacturing the
Wagner
ROTARY
AIR COMPRESSOR
and other air brake components improves operating efficiency and service life



The superior operating features of Wagner Rotary Air Compressors are directly related to Wagner's Rigid Quality Control manufacturing program—an important reason owners have so little trouble when the compressors are put into operation. At the factory every unit must pass careful inspection and run-in tests to assure that each compressor provides an adequate supply of air pressure at all times, with fast air recovery; and can provide safe, dependable performance and long service life.

If service should be needed—the entire compressor can be completely disassembled, serviced and put back into operation in a few hours. There are Wagner factory service branches in 23 major cities and a vast network of Wagner Air Brake Distributors throughout the United States and Canada to give prompt and efficient service on any air brake need.

It will pay you to include Wagner Air Brake Systems as standard equipment on the vehicles you manufacture. For further information, send for a copy of Bulletin KU-201.

1. Accurate machining assures the smooth, cool operation of the Wagner Rotary Air Compressor. Close dimensions on all planes of the rotor eliminate vibration . . . permit compressor blades to function smoothly at high speeds.

2. Accurate machining and gauge testing of the stator, as well as the rotor, also contributes to the rotary compressor's ability to operate for long periods of time without developing leaks or losing efficiency.

3. Compressor shafts are given the "cold box" treatment. When exposed to very low temperatures, the shaft diameter contracts. This altered shaft diameter allows proper insertion into a heated rotor to form a strong, composite unit.

4. Compressor rotors are subjected to high oven temperatures to expand rotor diameters. Shafts and rotors joined together under these extreme conditions resume their original relative size to create an extra strong assembly.

5. Assembled rotary compressors are hooked up to air lines and operating air pressure is applied for leakage tests. While holding pressure, entire compressor is submerged to determine whether any air is escaping.

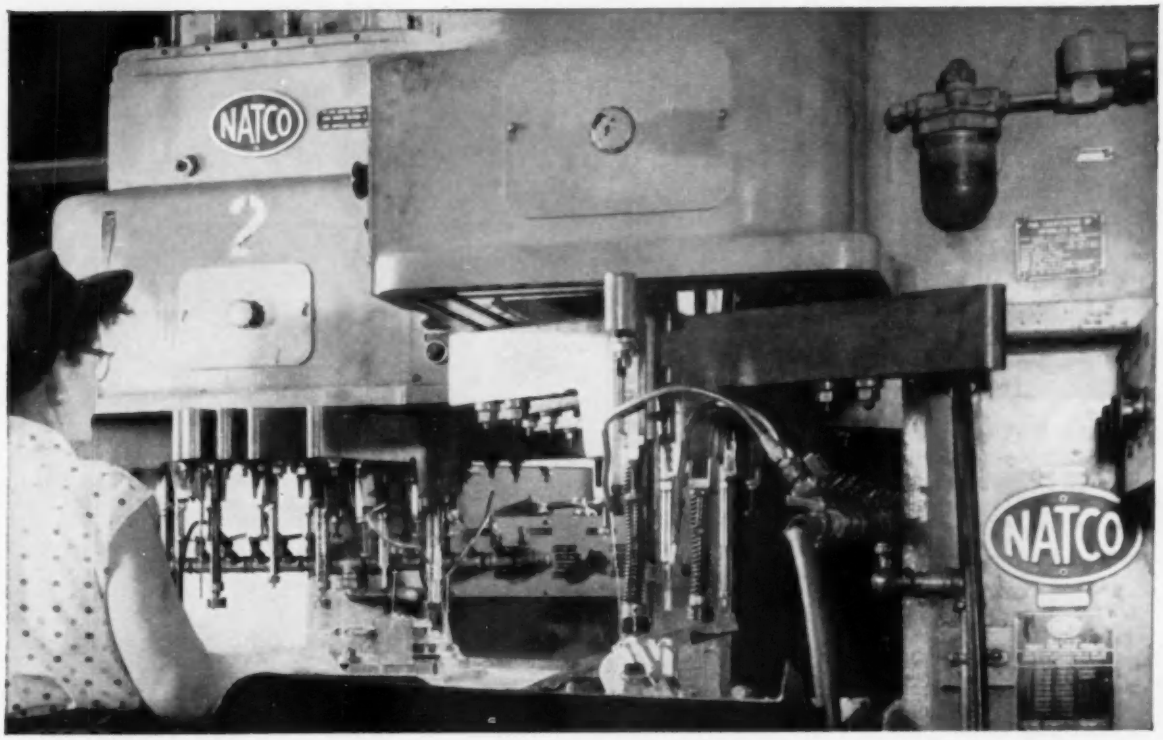
6. Every Wagner Rotary Air Compressor is given a rigorous "run-in" test to determine its resistance to overheating and its over-all performance. Running temperatures, vibration, noise and air output are carefully noted and analyzed.

WK58-1A

Wagner Electric Corporation
6363 PLYMOUTH AVENUE, ST. LOUIS 14, MO., U. S. A.
(Branches in principal cities in U. S. and in Canada)

The complete Wagner Air Brake Line includes many types and kinds of equipment—all fully described in Catalog KU-201. Write today for your free copy.

LOCKHEED HYDRAULIC BRAKE PARTS, FLUID and BRAKE LINING • AIR HORNS • AIR BRAKES • TACHOGRAPHS • ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES



Ten Natcos like these replaced 170 single spindles!

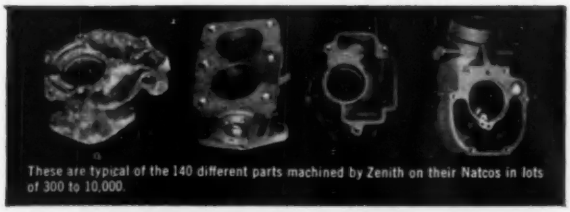
It's "reduce costs or else" in the hotly competitive carburetor business. That's why Zenith Carburetor Div. of Bendix Aviation Corp. embarked on a tooling program which resulted in substantial savings per casting machined.

Ten multiple spindle H-6 Natcos provided the greatest savings per machine dollar spent. By combining drilling and tapping operations, the Natcos eliminated the need for 170 single spindles. Look at the cost comparisons on two parts, for example—a die-cast cover and fuel bowl.

Formerly, the cover was machined by five operators using ten single spindles with ten jigs. The fuel bowl was formerly run by two operators on four single spindles using four individual jigs. Now these parts are run on two Natcos by a single operator at a direct cost savings of 81% on the cover and 70% on the fuel bowl.

Wherever hole-machining operations are performed one at a time, you'll find outstanding opportunities for cost reduction. Standard multi-spindle Natcos range from 1 hp, 10-spindle high-speed machines to giant heavy duties with 50 hp and up to 72 spindles. Natco also builds a complete line of special way-type, index and transfer machines.

A Natco field engineer can help you with your cost-reduction and production problems. Call or write today.



These are typical of the 140 different parts machined by Zenith on their Natcos in lots of 300 to 10,000.

Somewhere in Natco's experience is a money-saving idea for YOU!

NATIONAL AUTOMATIC TOOL COMPANY, INC.

Richmond, Indiana

Natco offices in Chicago, Detroit, New York, Buffalo, Boston, Philadelphia, Cleveland and Los Angeles; distributors in other cities.

NATCO

ALLIS-CHALMERS

Plan to stay ahead... MODERNIZE!

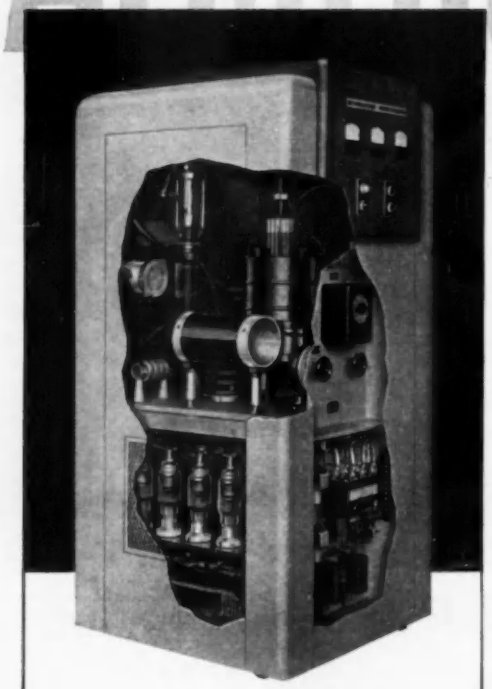
This is What Careful Buyers Want to Know about Induction Heating Equipment...

First — they want to know that they will get cost-cutting performance and dependability. This is basic... and it is the basic reason for the widespread acceptance of Allis-Chalmers induction heaters for hardening, annealing, brazing, melting.

Then — careful buyers want to know how well the equipment is backed up by the manufacturer's experience, engineering, research and service facilities. Again, Allis-Chalmers excels.

A-C engineering includes help in planning the most efficient use of induction heating in your operation, the design and manufacture of work fixtures and handling equipment, the testing of your material samples in A-C's modern laboratory. When your heater is installed, a field engineer from one of the A-C regional offices near you supervises the job.

There is an A-C representative in your area who can give you more details. Call him, or write Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin, for Bulletin 12B6430B.



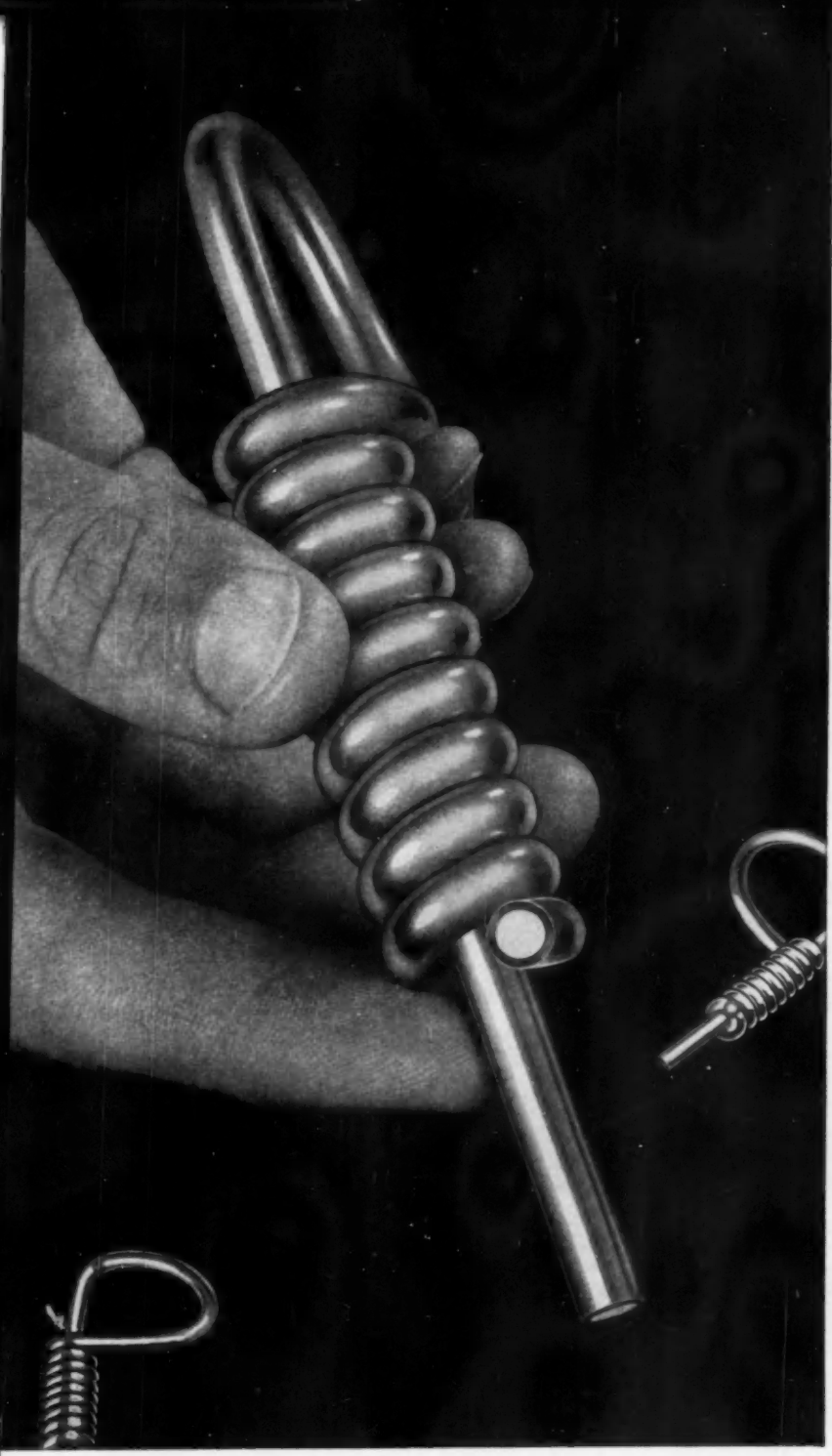
Check These Quality Features

1. Water-cooled oscillator tube has life expectancy of 5000 hours or more — with ample reserve capacity for emergencies.
2. Plate transformer is designed for continuous, heavy-duty service... has large reserve capacity.
3. Six-tube, three-phase full-wave rectifier section is standard... choke coil and capacitor network protect rectifier tubes from high-frequency currents.
4. Compact, attractive all-steel cabinet provides electrostatic and electromagnetic shielding.
5. Output circuit is based on simple principle which eliminates need for extra, expensive output transformers.
6. Precision automatic timer and all necessary controls are standard. No extras (except handling equipment) required.
7. All operating controls are clearly marked and mounted on one panel.
8. Safety features: heavy-duty control, high water temperature switch, high and low water pressure switches, fuses, interlocked doors.

And ... Bakelite standoffs, adequate clearances, clean wiring arrangements, ceramic coils, heavy duty relays.

A-C ALLIS-CHALMERS

A-5775



Get as "rough" as you want with

Copperply® wire!

Even the most severe usages known cause no measurable deterioration of the copper coating on Copperply Wire. This is both field and laboratory proved!

Shown here, for example, are standard wrap test specimens. Despite this extreme bending, neither microscopic examination nor ferroxyl testing show any hint of coating fracture or porosity.

You may well ask why. For one thing, the National-Standard electroplating process provides a homogeneous, high density coating . . . and, regardless of wire size, the maximum variation in copper thickness is less than 1% of diameter!

Copperply wire, offering you unmatched uniformity and service life, is available in the popular ASTM 30% and 40% conductivity grades. In addition, the precise control of the process permits the deposition of lighter coatings with the same degree of concentricity for varied electrical, electronic and mechanical applications where less copper is required. Copperply wire can be custom-produced to the copper thickness to give you the exact degree of conductivity or corrosion resistance required.

Write National-Standard, Niles, Michigan, for comprehensive Data Bulletin 202.

NATIONAL NS NATIONAL-STANDARD Company **STANDARD**

NATIONAL-STANDARD, Niles, Mich.; *tire wire, stainless, music spring and plated wires, flat and tubular braid and wire cord*
WORCESTER WIRE WORKS, Worcester, Mass.; *music spring, stainless and plated wires, high and low carbon specialties* • **REYNOLDS WIRE, Dixon, Ill.**; *industrial wire cloth*
WAGNER LITHO MACHINERY, Secaucus, N. J.; *metal decorating equipment* • **ATHENIA STEEL, Clifton, N. J.**; *flat, high carbon spring steels*
CROSS PERFORATED METALS, Carbondale, Pa.; *industrial, commercial, and decorative perforated metals*

Circle 196 on Inquiry Card for more data

STRENGTH... that's what FORTISAN-36 assures FIRESTONE auto hoses

Firestone uses Fortisan-36 to shape 21 different radiator hoses. This remarkable reinforcement yarn with high tensile strength and excellent stability gives you improved performance with less weight.

Firestone finds Fortisan-36's excellent stability lets you form and cure hose *easily* to any shape. You get longer life and excellent flexibility. Ask Firestone about this proved performer. See how performance-tested Fortisan-36 rayon takes the woes out of hose.

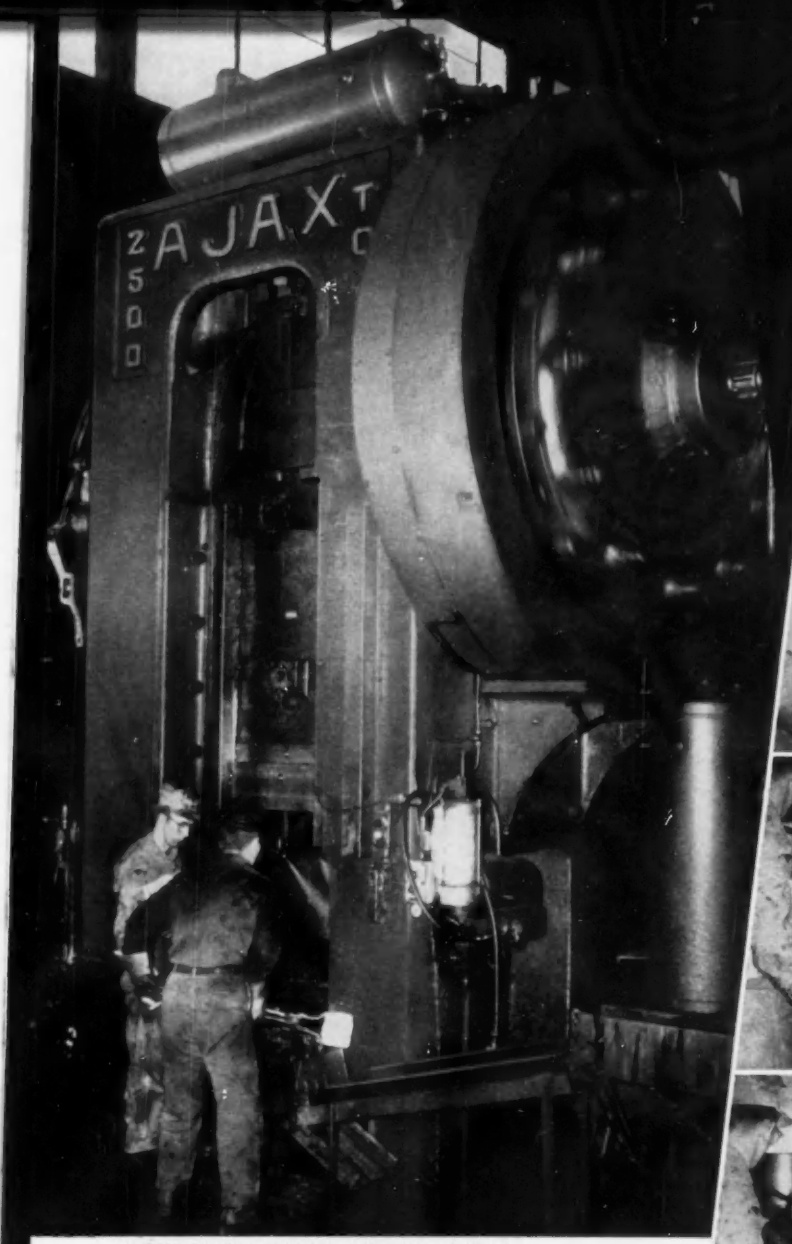
Celanese Corporation of America, Sales Development Department, Textile Division, Charlotte, North Carolina. Celanese® Fortisan®

DISTRICT SALES OFFICES: 180 Madison Ave., New York 16, N. Y. Room 10-141 Merchandise Mart, Chicago 54, Illinois. P. O. Box 1414, Charlotte 1, N. C.: 200 Boylston St., Chestnut Hill 67, Mass., 819 Santee St., Los Angeles, Calif.

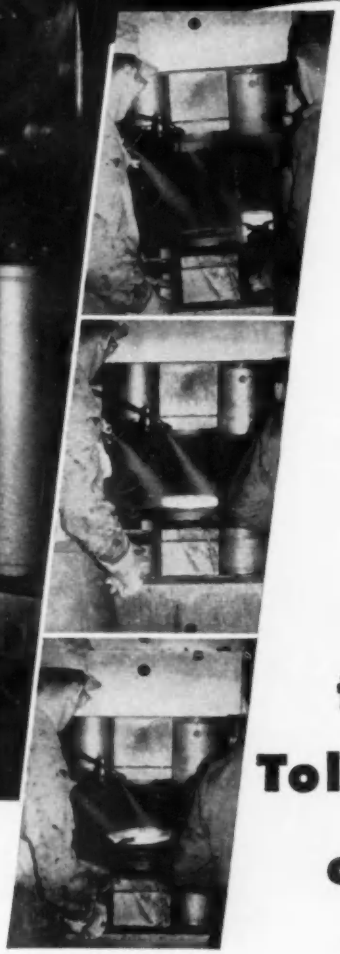
EXPORT SALES: Amcel Co., Inc. and Pan Amcel Co., Inc., 180 Madison Ave., New York 16, N. Y.

IN CANADA: Chemcell Fibres Limited, 1600 Dorchester Street West, Montreal, Quebec.

Fortisan-36... a Celanese industrial fiber



ACCURATE PRESS FORGINGS REDUCE MACHINING COSTS



JACKSON DROP FORGE CO., JACKSON, MICHIGAN

Progressive Multi-stage Forgings as shown above are Forged in one heat with less draft on AJAX Forging Presses. Machining is reduced to a minimum for a saving in both time and material.

Powerful AJAX Presses are fast operating and well-aligned—built with a solid steel frame in sizes 300 ton to 8000 ton capacity.

There is an AJAX Press to fit your particular Forging requirements . . .

Write for Bulletin 75C

Forged to Close Tolerances on AJAX Forging Presses

Circle 198 on Inquiry Card for more data

AJAX METAL WORKING MACHINES

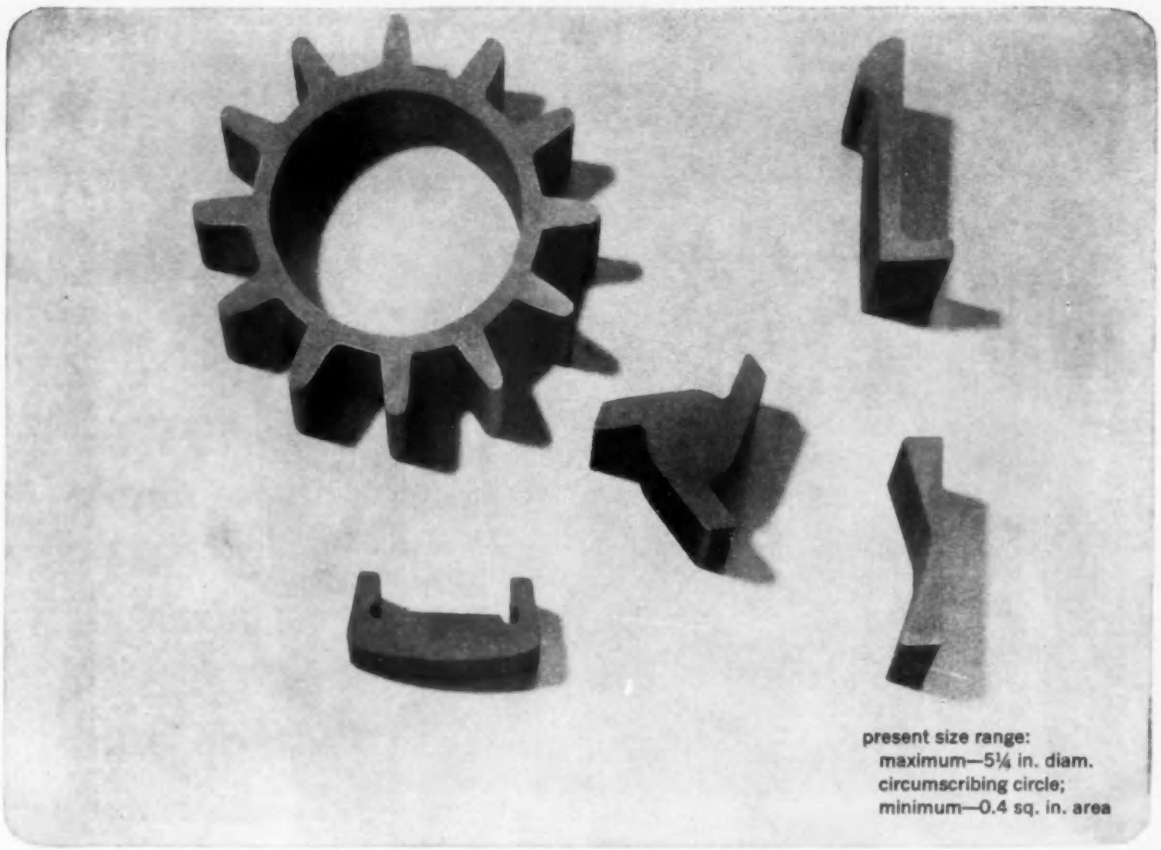
FORGING PRESSES — FORGING MACHINES — FORGING ROLLS — AJAX-HOGUE WIRE DRAWERS

THE AJAX MANUFACTURING COMPANY . . . . . CLEVELAND 17, OHIO

CHICAGO OFFICE: 110 S. DEARBORN ST., CHICAGO 3, ILLINOIS

W. P. WOOLDRIDGE CO. · BURLINGAME, CAL. · LOS ANGELES 22, CAL.

Experience**—the added alloy in **A-L Stainless, Electrical and Tool Steels



present size range:
maximum—5¼ in. diam. circumscribing circle;
minimum—0.4 sq. in. area

- 316 Stainless
- 304 Stainless
- Tool Steel Atlas 93
- SAE 4130
- 410 Stainless

Why hog out intricate shapes like these? **Let A-L extrude them in any steel**

If you're hogging out sections, paying for special mill rolls on small orders, or waiting for minimum rolling mill tonnages, Allegheny Ludlum Steel Extrusions are your answer. They will save you scrap loss, slash your machining costs, hold down your inventory requirements and cut delivery time.

Extruded shapes save money on expensive materials and on costly machining. Non-ferrous applications in the last decade have proven it. Now even greater savings are possible with tough, strong metals in Allegheny Ludlum Steel Extrusions.

Intricate extruded shapes in all stainless grades, tool steels, carbon steels, electrical steels, high temperature alloys, even zirconium and nickel alloys are now in production at Allegheny Ludlum, cutting costs in many different industries.

Costs and minimum order quantities are surprisingly low. Charge for die design is under $200. Orders taken for as little as 40 pounds.

To learn more about the time and cost-cutting possibilities of Allegheny Ludlum Hot Steel Extrusions, send for the extrusion booklet—12-pages of design and engineering information with process and product explanation, material properties, design tips and limitations, tolerances, order instructions, etc. Or call any A-L office for technical assistance. ***Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh 22, Pa.*** Address Dept. AI-11.

WSW 7119

ALLEGHENY LUDLUM

for warehouse delivery of Allegheny Stainless, call RYERSON

Export distribution: AIRCO INTERNATIONAL

EVERY FORM OF STAINLESS . . . EVERY HELP IN USING IT

Do you need a reliable carburetor to meet your specialized requirements? Then Zenith* Carburetor is your answer. We either have built or have the skills to build the carburetor you want—at low cost.

Our many contributions in every phase of carburetor research and development are your assurance of satisfaction. **Zenith actually has more experience in more fields with more engine types than any other carburetor manufacturer!**

*REG. U. S. PAT. OFF.

Zenith Carburetor Division

696 HART AVE., DETROIT 14, MICH.

Bendix
AVIATION CORPORATION

Circle 200 on Inquiry Card for more data

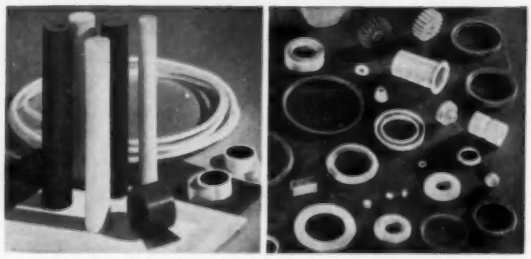
Bring R/M's greater experience, better facilities, to bear upon <u>all</u> your TEFLON* problems

There is no substitute for the years of experience which Raybestos-Manhattan engineers have had in handling "Teflon"—nor for the unequaled plant facilities which implement this know-how. That is why we suggest that you come to R/M for *all* your "Teflon" needs.

The extruding, molding, machining, and bonding of "Teflon" is an old story at R/M. We are familiar with applications in the automotive and aircraft industries, where "Teflon" serves better than any other material, and we will be glad to fabricate parts and components to your precise specifications.

In addition, we can supply you with the other R/M "Teflon" products, such as flexible "Teflon" wire braid covered hose, "Teflon" sheets, tape, tubes, rods, and bondable "Teflon." Get in touch with your nearest R/M district office for the "Teflon" products you require and engineering information. Or write us for further information and literature.

*A Du Pont trademark



Other R/M "Teflon" products useful to your industry include centerless ground rods held to very close tolerances; stress-relieved molded rods and tubes; parts painstakingly machined to your specifications. Our mechanical grade of "Teflon"—Raylon—has many characteristics of virgin "Teflon."

R/M

RAYBESTOS-MANHATTAN, INC.

PLASTIC PRODUCTS DIVISION FACTORIES: MANHEIM, PA.; PARAMOUNT, CALIF.

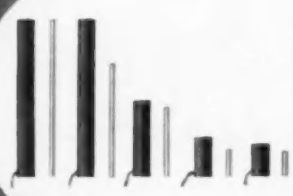
Contact your nearest R/M district office listed below for more information or write to Plastic Products Division, Raybestos-Manhattan, Inc., Manheim, Pa.

BIRMINGHAM 1 • CHICAGO 31 • CLEVELAND 16 • DALLAS 26 • DENVER 16 • DETROIT 2 • HOUSTON 1 • LOS ANGELES 58 • MINNEAPOLIS 16
NEW ORLEANS 17 • PASSAIC • PHILADELPHIA 3 • PITTSBURGH 22 • SAN FRANCISCO 5 • SEATTLE 4 • PETERBOROUGH, ONTARIO, CANADA

RAYBESTOS-MANHATTAN, INC., Engineered Plastics • Asbestos Textiles • Mechanical Packings • Industrial Rubber • Sintered Metal Products • Rubber Covered Equipment
Abrasive and Diamond Wheels • Brake Linings • Brake Blocks • Clutch Facings • Laundry Pads and Covers • Industrial Adhesives • Bowling Balls

SANBORN *Transducers*

FOR LINEAR MEASUREMENTS...



DISPLACEMENT

LINEARSYN Differential Transformers

Six series of Sanborn Linearsyns — three of the shielded type, three unshielded — are available, with five models in each series. Linearity is better than 1% of full scale output in all models. Temperature range is from −50° to 205°F.
Special design features include coil assemblies hermetically sealed in epoxy, laminated phenolic jackets (unshielded types) or heavy plated steel jackets (shielded types), improved lead wire strain relief, high permeability alloy cores. Models with axial leads are also available on special order. Within each series all models have identical diameters, tap sizes, lead wires; only the lengths of coil assemblies and cores vary.

Typical Linearsyn Characteristics

Series* (Unshielded)	(Shielded)	Strokes* (±Inches)	Freq. Ranges	Sensitivities* (Volts/inch per volt of excitation at std. carrier freq.)
575DT	585DT	.050 - 1.00	400 cps - 10 kc	56 - 3.70
576DT	586DT	.050 - 1.00	60 cps - 400 cps	.70 - .90
590DT	595DT	.005 - .100	400 cps - 20 kc	1.60 - 2.60

*Maximum and minimum values available within each series; data on individual models on request.

VELOCITY

LVsyn Velocity Transducers

LVsyn pickups may be used to measure *linear velocity* directly, *displacement* with a simple integrating circuit, or *acceleration* with a differentiating circuit. There are twenty-four models, all self-generating with shielded cylindrical coil assemblies and high coercive force permanent magnets. Twelve models use regular magnet cores; twelve have *non-breakable* magnet cores. Characteristics of the two groups are the same except for output sensitivity, core length and weight. Features include high sensitivity, single-ended or push-pull output, accurate and stable calibration, unlimited resolution, wide range of sensitivities and sizes, temperature range of −50° to 200°F. They can be immersed in hydraulic fluid. No mechanical connection between coil and core permits low friction level. End stops or displacement limits not needed; undamaged if limits are extended.

Typical LVsyn Characteristics

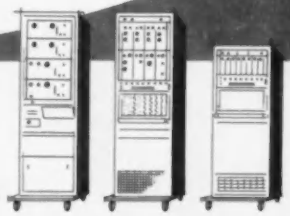
Model	Displacement: Nominal Working Range (Inches)	Displacement: Maximum Usable Stroke (Inches)	Electrical Characteristics: Voltage Output mv/inch	Electrical Characteristics: Total Impedance Series R ohms	Electrical Characteristics: Total Impedance Connection L henrys
3LVA5*	0.50	1.30	120	2,000	0.085
6LV2*	2.0	3.4	500	19,000	2.4
6LV2-N	2.0	3.4	250	19,000	2.4
7LV9*	9.0	11.0	350	17,000	2.8

*Four of the twenty four models available, selected to show minimum, approximate mid-range and maximum working ranges as well as the difference in sensitivity between a regular magnet core model (6LV2) and a non-breakable magnet core model (6LV2-N).

NEW!

COMPLETE DISPLACEMENT TRANSDUCER

"Probe" style, uses differential transformer. With cable and adapter for connection to Sanborn 150, 350 Series Carrier Amplifiers. Stroke ±0.070", high sensitivity, linearity 0.5%, infinite resolution, contact pressure as low as 10 grams. Stainless steel body, carbide tipped contact rod, jeweled bearings. Two models: 580—plug-in cable, flange mounting; 581—miniature, integral cable.



for MULTI-CHANNEL RECORDING

Sanborn direct writing systems now include 1- to 8-channel "150" Series, with a choice of 12 plug-in Preamplifiers; new single-cabinet, compact 6- and 8-channel "350" and "850" Series with interchangeable Preamplifiers, flush-front recorder with electrical pushbutton chart speed control and transistorized Power Amplifiers, and numerous features for high reliability and operating convenience.

For complete facts, call your local Sanborn Industrial Sales-Engineering Representative or write the Industrial Division in Waltham.

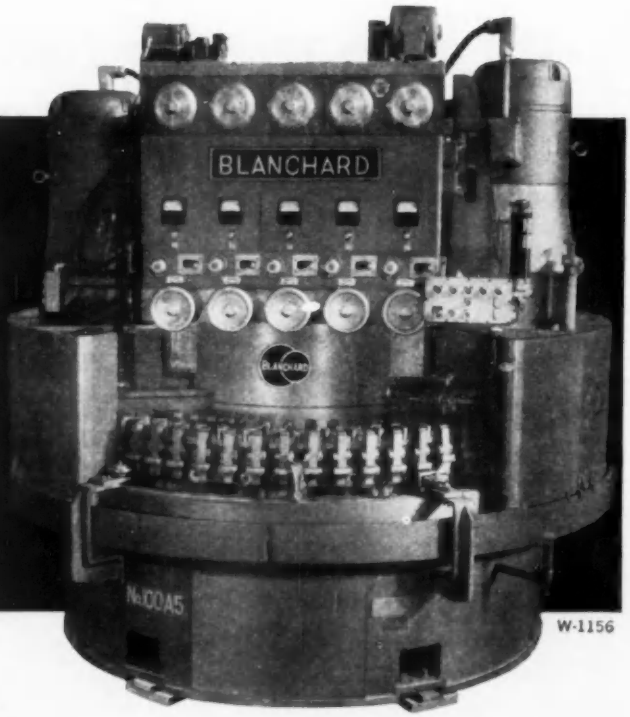
(All data subject to change without notice)

SANBORN COMPANY

Industrial Division

175 Wyman Street, Waltham 54, Mass.

For mass production grinding at lowest unit cost... Blanchard Center Column Surface Grinders



W-1156

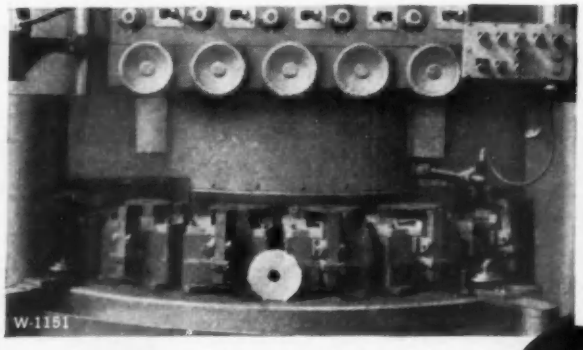
For long-run work at high production rates, it's just plain good economic sense to grind flat surfaces on the Blanchard. These automatic multiple-spindle machines are widely used in the cost-conscious automotive industry for close-tolerance grinding from the rough castings or forgings. Time-saving Blanchard fixtures allow a single operator to handle large quantities of parts every shift.

Blanchard Center Column Grinders are available with three, four or five grinding spindles and 80", 90" or 100" O. D. work tables to handle a wide variety of parts. The No. 100-A5 is shown.

New functional design, with minimum floor space, provides several advantageous features. Sludge disposal is automatic to coolant reservoir . . . power rapid traverse on each head speeds wheel changes. Wheels are easily reached through separate doors from the floor. Centralized lubrication . . . all operating controls are easily accessible, with complete safety features for operator and machine protection . . . large loading-unloading area. These and other features result in better grinding jobs in less time—*and at less cost*—when you Put It On The Blanchard.

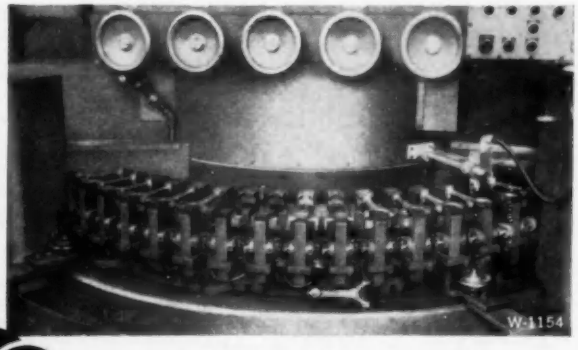
Send for illustrated folder No. 374 which describes the 3 models of the Center Column machines in detail.

Typical Grinding Jobs Performed on the Blanchard Center Column Grinder:


W-1151

Front Pump Cover. MATERIAL: Cast Iron. STOCK PER SIDE: $\frac{1}{16}$" to $\frac{25}{32}$". NO. OF SIDES GROUND: One. LIMITS: Must be flat within .002". PRODUCTION: 360 pieces per hour (net). These pieces are ground in a 20 station fixture, on a No. 100-A5 Blanchard.

BLANCHARD


W-1154

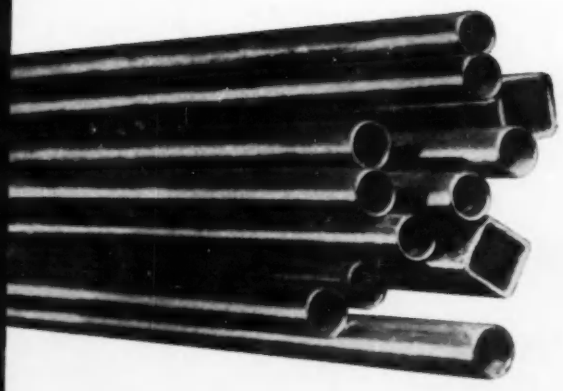
Connecting Rods. MATERIAL: Steel forging. STOCK PER SIDE: $\frac{1}{32}$". 1st OPERATION: Grind 2 sides and 2 ends. LIMITS: ±.001". NO. OF SIDES: 2. PRODUCTION: 600 per hour, 1200 surfaces (net). These pieces are ground in a 60 station fixture, on a No. 100-A5 Blanchard.

THE BLANCHARD MACHINE COMPANY 64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.

Circle 203 on Inquiry Card for more data

"Whom do I call for mechanical tubing?"

"Why, your USS Shelby Distributor, of course!"



When a steel tubing problem confronts you, get in touch with your Shelby® Distributor. His ideas, experience and engineering know-how will prove most valuable.

Your Shelby Distributor carries a complete stock of USS® Shelby Seamless Mechanical Tubing—round, square, rectangular, or other special shapes in commercial sizes from ¼" OD to 10¾" OD. Wall thicknesses from .035" to 2.000" in a wide range of steel grades and anneals.

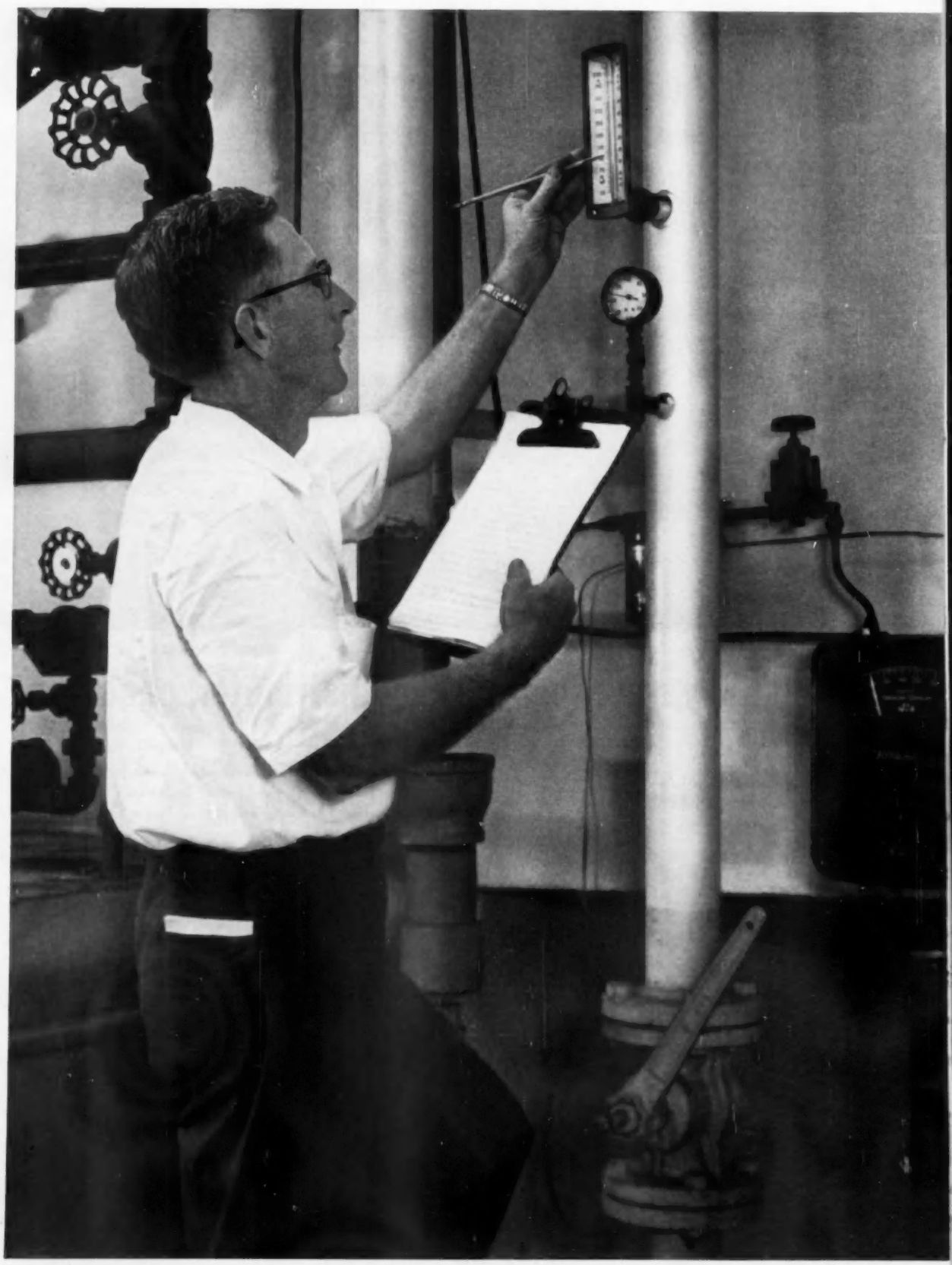
So contact your USS Shelby Distributor. He is experienced, capable and close at hand. He gives speedy, efficient service. Contact him!

"Shelby Tubing is made by the world's largest and most experienced manufacturer of tubular products—National Tube."

National Tube
Division of USS United States Steel

*TRADEMARK

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors • United States Steel Supply Division
United States Steel Export Company, New York

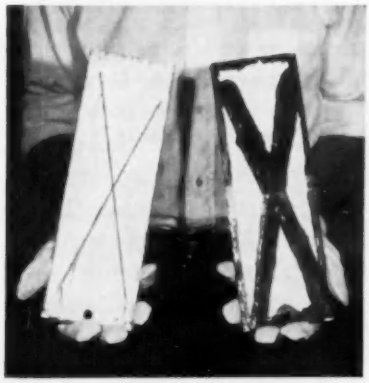


Read the Temperature and SAVE!

New Cold Bonderite System Cuts Heat Costs Up to 70%

The temperature gauges on the input lines of a typical Cold Bonderite System installation tell the story. 40° to 75° cooler in cleaner, rinse and Bonderite than in the conventional hot phosphating installation.

And all that heat saved translates into dollars saved, because chemical costs are comparable, as is the effective protection of the coatings produced.



Salt spray tests show effectiveness of coatings produced by Cold Bonderite System.

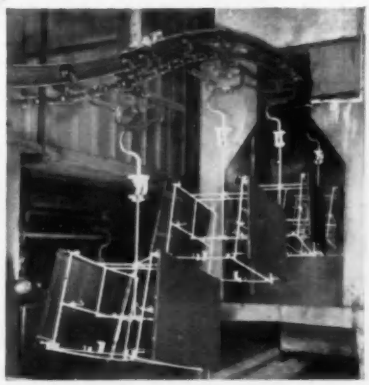
This is a thoroughly tested and proven system. The Cold Bonderite System is in use right now in many plants in many industries. And more are changing to it as they hear about the spectacular savings.

- A large automotive plant reports savings at the rate of 40 carloads of coal per year.
- An appliance manufacturer says the Cold Bonderite System is saving 5¢ per cabinet.
- Another manufacturer shut down one of his boilers because of reduced heat requirements.
- An automotive plant is saving about 12¢ per body.

There are other operational savings besides heat when you use the Cold Bonderite System. You'll use about 25% less water. You'll save electricity because you won't need to run an exhaust fan. You'll save on maintenance. You'll cut down-time, since there's no waiting for cool-off should service be required.

There are so many benefits and advantages to the new Cold Bonderite System that you can't afford not to investigate it for *your* plant.

Call or write today!



Parker quality and Parker dependability mean that your production lines will roll steadily and efficiently.

PARKER RUST PROOF COMPANY
2178 E. Milwaukee, Detroit 11, Michigan
Tel: TRinity 5-3377

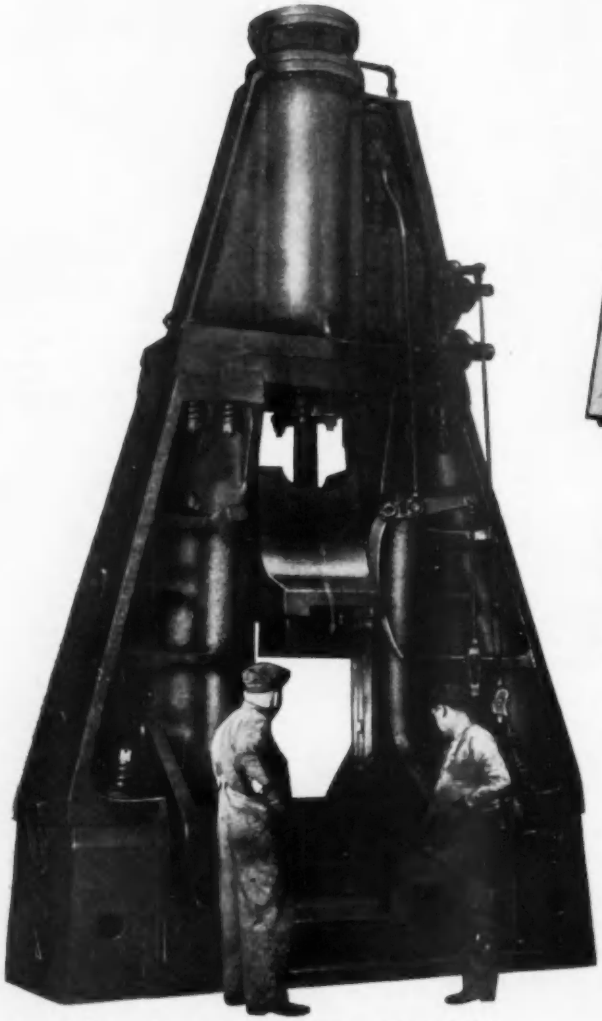
BONDERITE	BONDERITE and BONDERLUBE	PARCO COMPOUND	PARCO LUBRITE	TROPICAL
corrosion resistant paint base	aids in cold forming of metals	rust resistant	wear resistant for friction surfaces	heavy duty maintenance paints since 1883

Since 1914—leader in the field

*Bonderite, Bonderlube, Parco, Parco Lubrite—Reg. U.S. Pat. Off.

Do your Steam Hammers look like this?

TIME TO MODERNIZE



CHAMBERSBURG
STEAM DROP HAMMERS

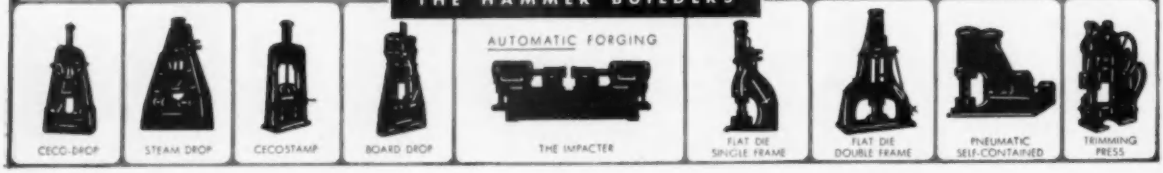
have kept pace with modern forge shop requirements. With Chambersburg Steam Drop Hammers you get more forging per blow and more forgings per hour for higher production. And—at the same time you'll find production savings in lower power consumption, less downtime, better die alignment. Every feature of Chambersburg Hammers is designed to produce forgings at the lowest possible cost per piece.

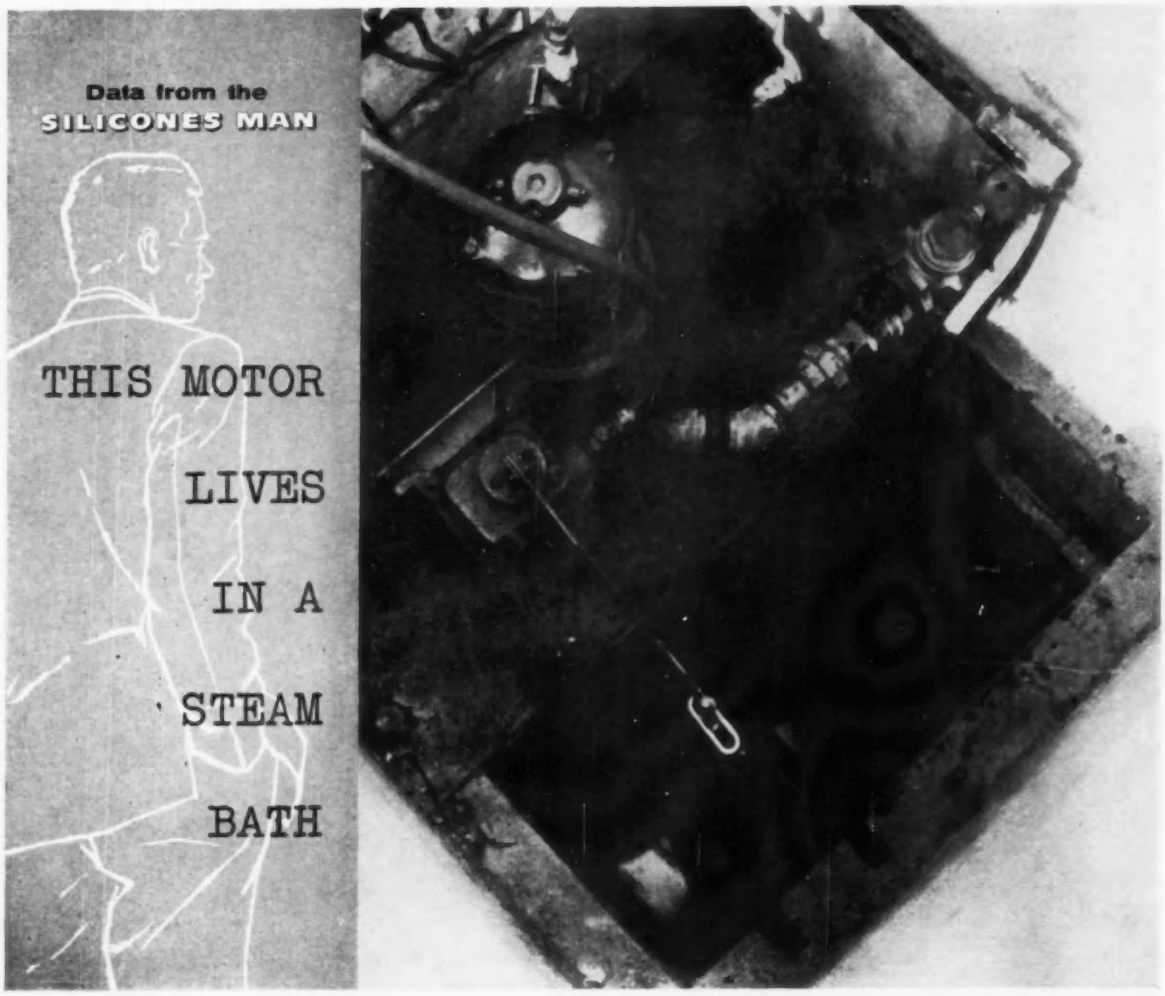
Write for Bulletin

CHAMBERSBURG ENGINEERING COMPANY . . . . . CHAMBERSBURG, PA.

CHAMBERSBURG

THE HAMMER BUILDERS





When water accumulates in an underground steam distribution system this pump goes to work. But during periods of heavy rain, the water rises and covers the pipes, giving off clouds of steam. Failures were frequent. Since rewinding to Class H specifications using UNION CARBIDE R-620 Silicone Insulating Resin, there has not been a single failure! Time and time again, where a motor is subjected to high temperatures, corrosion, overloads, or dirt, the answer has been found in Class H insulation.

You can easily give your rewind customers all the advantages of Class H insulation, because R-620 Silicone Insulating Varnish is as simple to use as ordinary varnishes. For example, at 450 deg. F., a Class H motor would cure in less time than a Class B motor of the same size at 300 deg. F. The time consuming step-by-step curing cycles required by earlier materials are eliminated.

UNION CARBIDE R-620 is easily adapted to your shop practice. You will find that it gives a hard, tough, yet flexible finish. The proper viscosity is built in, eliminating frequent solvent additions. No additional treatments are required to protect against moisture or corrosive atmospheres.

Find out more. Write for the booklets, "UNION CARBIDE Silicones for Dependable Service" and "More for your Silicones Dollar." Address Silicones Divsion, Box KB 6703, Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y.

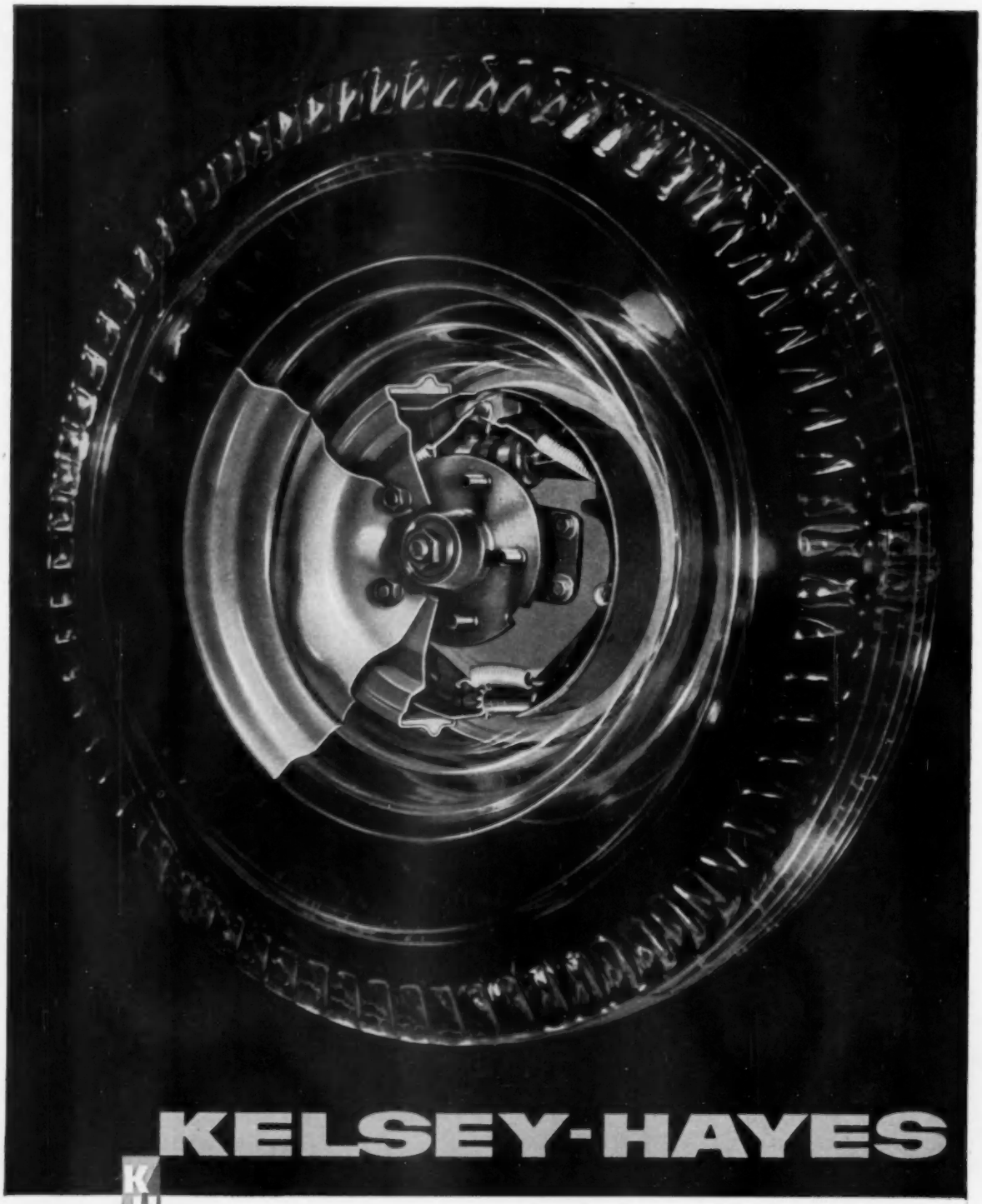
Unlocking the secrets of silicones

Rubber, Monomers, Resins, Oils and Emulsions

"Union Carbide" is a registered trade-mark of UCC.

UNION CARBIDE TRADE-MARK SILICONES

Circle 206 on Inquiry Card for more data



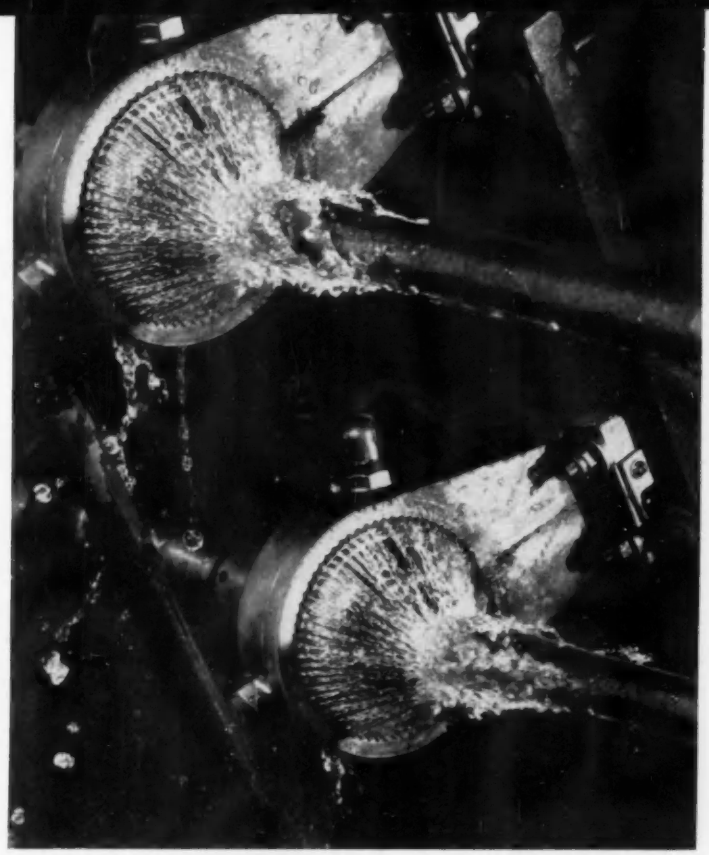
KELSEY-HAYES COMPANY
Gen'l Offices: Detroit 32, Mich.
Automotive, Aviation and Agricultural Parts • Hand Tools for Industry and Home

18 PLANTS: Detroit and Jackson, Michigan; Los Angeles; McKeesport, Pa.; Springfield, Ohio (Speco Division); Utica, New York (Utica Drop Forge & Tool Division); Davenport, Iowa (French and Hecht Division); Philadelphia (Reinta Division); Clark, New Jersey (New Jersey Division); Windsor, Ontario, Canada.

Reflected in this modern motor car wheel, hub-and-drum, and brake assembly are the precision and excellence of quality which have earned for Kelsey-Hayes a respected name among suppliers to the automotive industry since 1908. Products representative of the specialized skills and facilities of Kelsey-Hayes in the manufacture of fine automotive parts and components include: *wheels, brakes, hubs and drums, power brakes, transmission bands and other chassis parts.*

Circle 207 on Inquiry Card for more data

How Westinghouse Induction Heating Saved $152,880



Here is how Hightower-Morse & Company is successfully meeting the cost-price squeeze with Westinghouse Induction Heating. In the horizontal hardening of automotive axles, this progressive manufacturer found it imperative to invest in modern equipment to produce an improved product and hold the price to customers at a reasonable level. Here are the facts:

	SAVING PER AXLE
1046 carbon steel replaces costly 4145 alloy steel, yet scores high Rockwell hardness and greater toughness	75¢
Eliminates a stress-relief operation	13¢
Previously, all axles were hardness-tested; now necessary to spot-test only 3%	5¢
Hobbing machine cutters last longer	3¢
Drills last longer	1/3¢
Lathe tools last longer	1/5¢
Increases production because of less down time for changing cutting tools	1-9/10¢

Another saving—gas furnaces must run 24 hours a day at estimated $10 per-hour fuel cost, but Westinghouse Induction Heating uses current only when work is going through; electricity costs $3.50 per hour.

What's your problem—rejects, high costs, quality control? Your Westinghouse Induction Heating specialist can suggest applications in your plant for Westinghouse integrated production-line equipment.

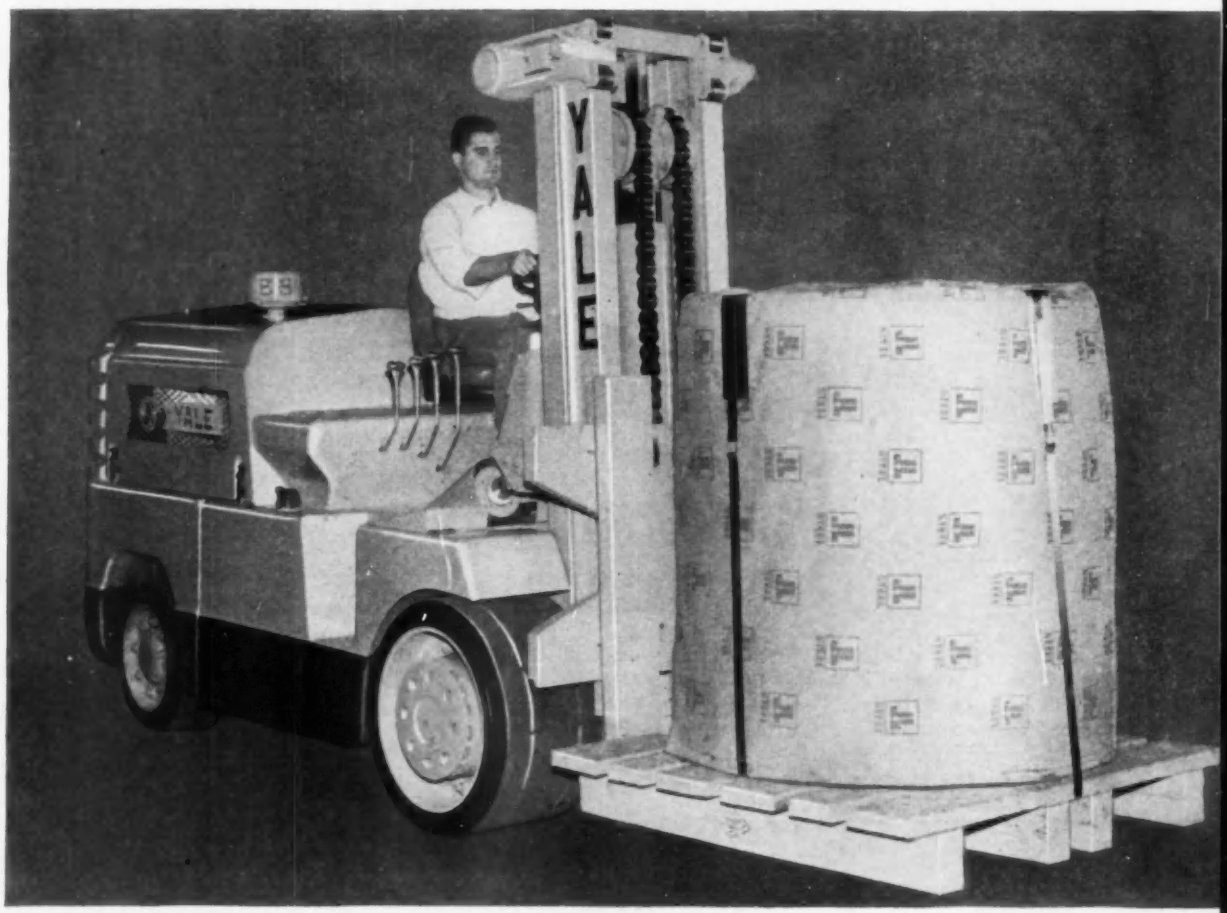
Axles pass through coils of Westinghouse horizontal scanner two at a time at Hightower-Morse & Company. This one-man operation requires 60% less space than furnace heating; gives exact control of temperature and quench. J-35005-R

NEW—from Westinghouse Engineering and Development—LOW DISTORTION Induction Hardening Machine. It combines hardening, drawing and distortion reduction in one operation. Ask your Westinghouse specialist for complete information.

YOU CAN BE SURE...IF IT'S Westinghouse

Circle 208 on Inquiry Card for more data

Yale introduces 2 short trucks



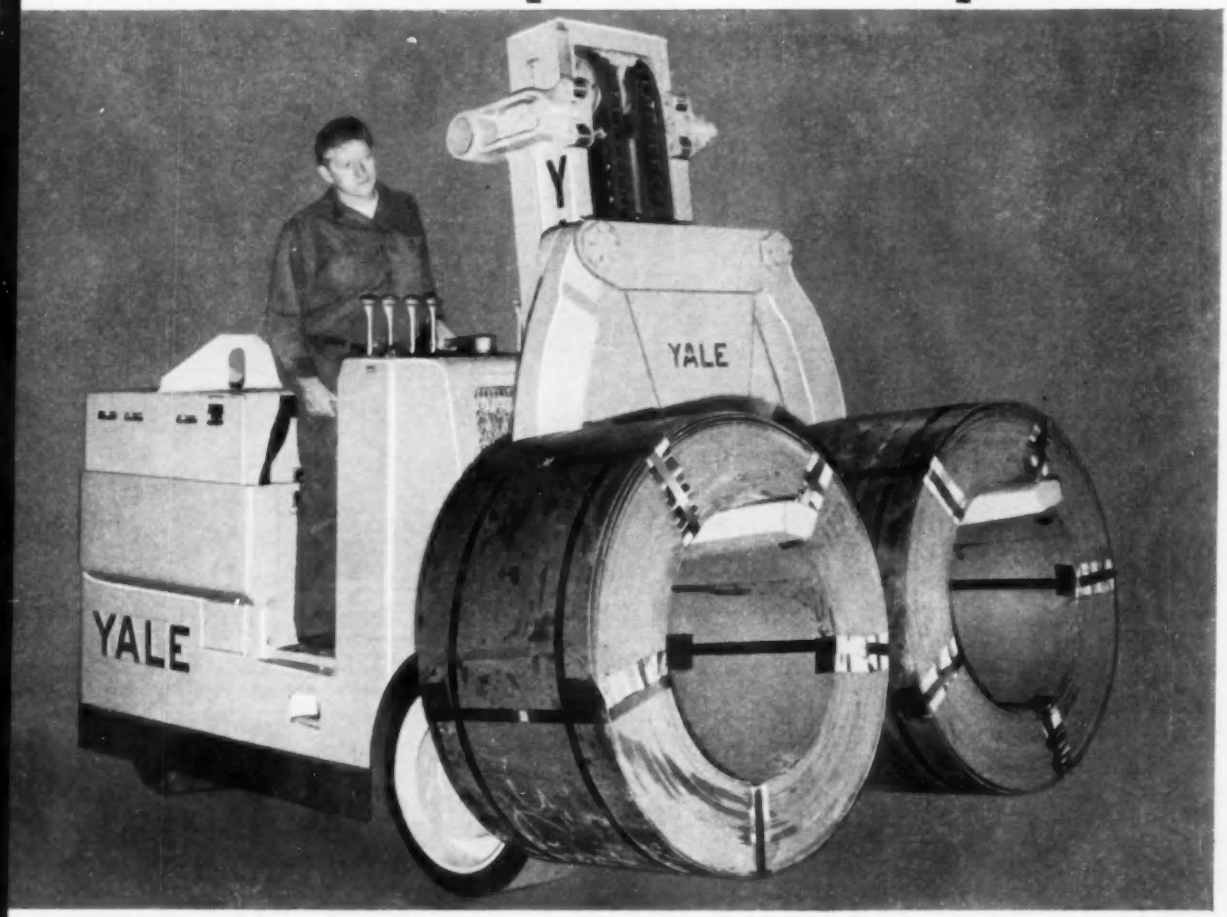
Gasoline

Yale G5 Series—Only Series of its Kind to Feature Rugged Design and Fast Cycle Operations. For heavy industry. • Instant power for fast acceleration from fully automatic torque converter transmission with 2 speed ranges. • Lifting speeds up to 60 ft. per minute. • Turning radius, only 112"—permits easy movement in and out of box cars. • Operator positioned for excellent visibility. • Powerful V-8 industrial engine. • High underclearance. • For use with forks, single ram, hydraulic split ram or specialized attachments. • Available for use with LP-gas. • Capacities: 15,000 to 20,000 lbs.

Both guarantee

Both economical new Yale Trucks—gas and electric—feature famous Yale Integrated Design and premium engineering advances as standard components. You get extra rugged channel assembly—Yale Planetary Drive Axle assembly—hydraulic wheel brakes—tough steel frame construction. For full information about these and other Yale gas, LP-gas, electric, hand trucks, industrial tractor shovels, hand and electric hoists—write The Yale & Towne Mfg. Co., Materials Handling Division, Philadelphia 15, Pa., Dept. A-711.

that handle up to 20,000 pounds



Electric **Yale K410 Series—Combines Heavy-Industry Power With a Turning Radius of Only 92⅝".** Designed for easy serviceability. • Accommodates 60 to 72 volt batteries to meet any power requirement. • Telescopic, hydraulic lift gives maximum lift per overall height. Easy to maneuver in and out of box cars. • Operator has choice of two stations for excellent visibility at all times. • Hydraulic tilt to safety nest-loads speeds handling operations. • For use with forks, single ram, hydraulic split ram or specialized attachments. • Available with engine-generator power unit. • Capacities: 12,000 to 20,000 lbs.

faster cycle operations

YALE* *REG. U. S. PAT. OFF

YALE & TOWNE

INDUSTRIAL LIFT TRUCKS & TRACTOR SHOVELS • HOISTS

GASOLINE, ELECTRIC, DIESEL & LP-GAS INDUSTRIAL LIFT TRUCKS • WORKSAVERS
WAREHOUSERS • HAND TRUCKS • INDUSTRIAL TRACTOR SHOVELS • HAND AND ELECTRIC HOISTS

YALE MATERIALS HANDLING DIVISION, THE YALE & TOWNE MANUFACTURING CO. MANUFACTURING PLANTS: PHILADELPHIA, PA.; SAN LEANDRO, CALIF.; FORREST CITY, ARK.

Circle 209 on Inquiry Card for more data

NEW LOOK IN PRODUCTION LINES

From Material to Product in ONE PACKAGE

Need help to reduce your manufacturing costs and raise your production? Why not check Federal/Warco Packaged Production Lines – automated production from coil strip or sheet blanks to finished product.

Only Federal can offer you actual single source responsibility with major line components of resistance welders, punch presses, mechanical welder presses, automatic arc welders, expanders, destackers, transfer equipment and digital control – all designed and built in Federal's plants.

Federal pioneered and are leading designers and builders of packaged lines. Talk with a Federal representative when next you're planning production welding or press equipment.

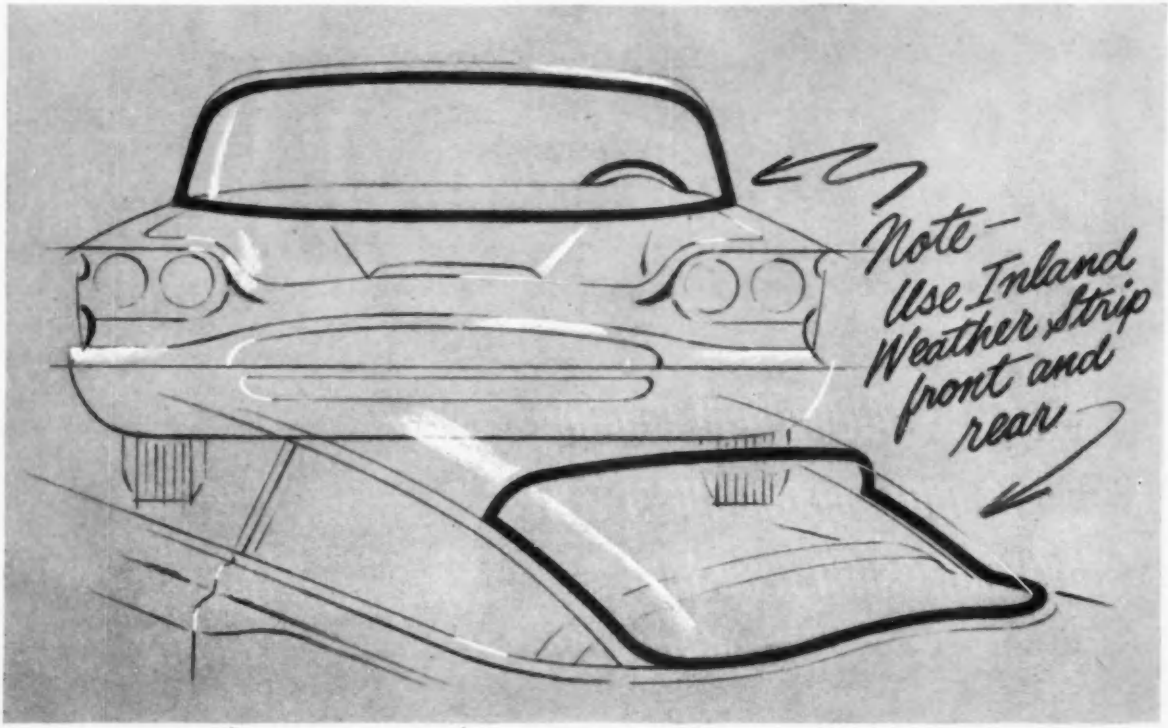
Federal / Warco
PACKAGED
PRODUCTION LINES

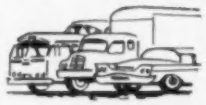
THE FEDERAL MACHINE AND WELDER COMPANY - WARREN, OHIO

AFFILIATED WITH BERKELEY-DAVIS, INC., DANVILLE, ILLINOIS, MANUFACTURERS OF AUTOMATIC ARC WELDING EQUIPMENT.

FREEDOM

TO DESIGN FOR A FUTURE THAT SPARKLES



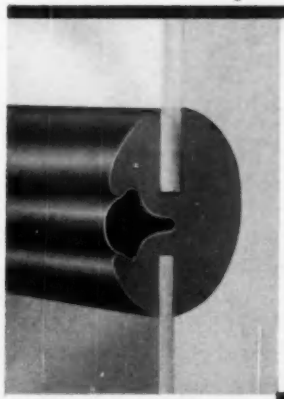

Transportation Industry


Railway Equipment


Over-the-road Equipment


Marine Applications


Commercial Structures



Filler Strip zips into locking channel, compressing the entire strip into permanent, leak-proof seal.

The wonderful versatility of Inland Self-Sealing Weather Strip allows complete design freedom with glass of any size or shape for modern vehicles.

In any weather, Inland Weather Strip never leaks. Shocks or vibrations have no effect on its weather-proof qualities. Inland's filler strip keeps both glass and body panel under compression—and lowers costs, too.

Important savings are possible in design, construction and installation. Inland Self-Sealing Weather Strip needs no special cement, binders, or clamps. One man can install it easily and quickly. Replacement takes minutes.

Make your designing easier with Inland Self-Sealing Weather Strip—available in standard sizes, or made to your specifications. Write, wire, or phone for detailed information.

INLAND MANUFACTURING

INLAND

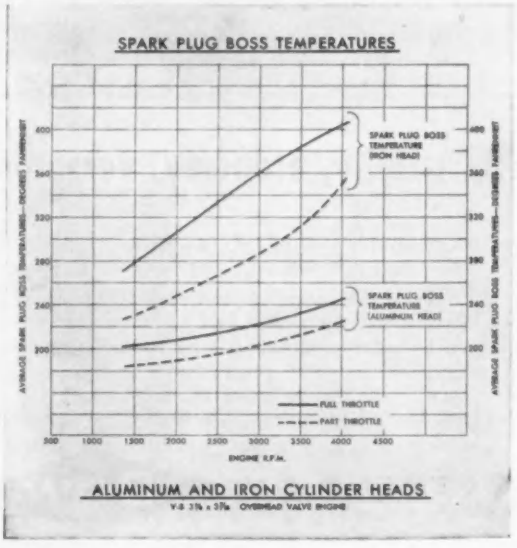
SELF-SEALING WEATHER STRIP

Inland Manufacturing Division, General Motors Corporation, Dayton, Ohio

Circle 211 on Inquiry Card for more data

Aluminum cooling system
is more economical...weighs 55 per cent less...
stays corrosion resistant...

reduces costs



Over 14 years ago, Alcoa's automotive and research engineers focused their efforts on the development of a more efficient cooling system—a cooling system to lick the twin problems of weight and corrosion. Today aluminum cooling system components are a practical reality and foreshadow the all-aluminum system of the future. They point the way to more horsepower per pound, better weight and temperature distribution.

Alcoa Successfully Applies Aluminum in Cylinder Heads, Water Pumps, Heat Exchangers. Through design improvements and alloy development, Alcoa provides weight savings of more than 55 per cent with substantial savings in cost. The aluminum head assembly provides superior heat transfer—valves run cooler and seat better, spark plug boss temperatures are reduced by as much as 165°.

In Service Tests and Field Experience. Alcoa engineers investigated cooling system parts under the most severe conditions. They found that under the usual circumstances no change needed to be made in operating practices. While iron parts need constant protection by corrosion inhibitors, aluminum cooling system components experience comparatively little attack by most coolants. Where applications involve the use of iron and aluminum parts, proper choice of aluminum alloy and design features reduce corrosion and erosion.

Let Alcoa Help. Alcoa's work in the development of the all-aluminum engine and cooling system has resulted in a wealth of accumulated experience in the application of aluminum in the automotive field. Bring your design and application problems to Alcoa. Its engineers and complete facilities are yours to tap. Let us work with you. Write Aluminum Company of America, 1848-L Alcoa Building, Pittsburgh 19, Pennsylvania.

Water pump cover. This die-cast aluminum part, together with the aluminum front cover and pump housing, lends itself to more economical volume production techniques.

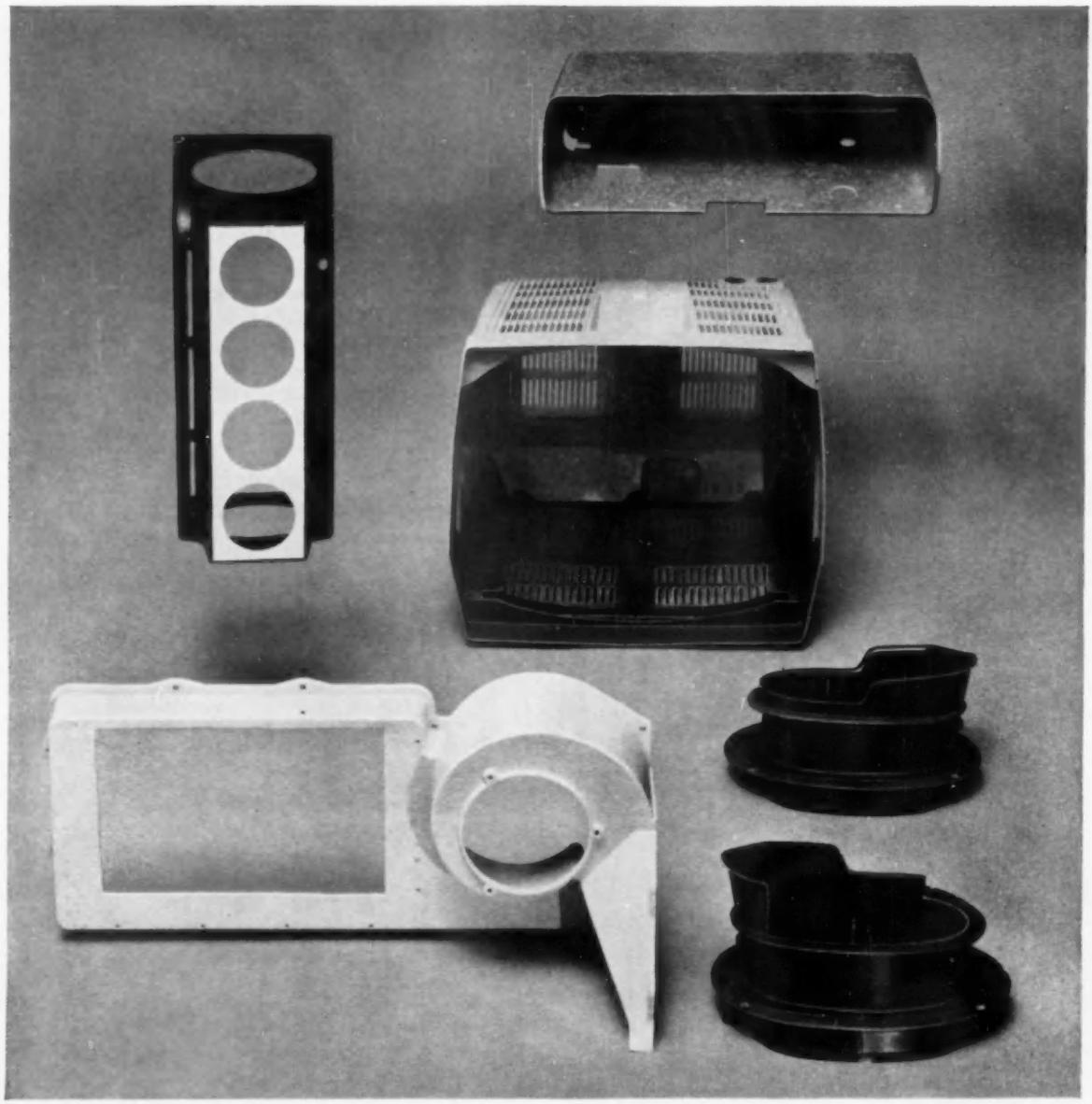
An all-aluminum condenser for automobile air-conditioning units. Core weighs seven pounds, depth less than an inch. Aluminum fin stock and rectangular tubes provide lightness, best heat conductivity.

Thermocouple readings taken in Alcoa Process Development Laboratories reveal aluminum's superior thermal conductivity for improved performance. Besides reducing temperature level, aluminum holds temperature range to 60° from part load to maximum horsepower.

ALCOA ALUMINUM GIVES *EVERY* CAR MORE GLEAM AND GO

ALCOA ALUMINUM

Circle 212 on Inquiry Card for more data



Wide range of premix moldings by the Plastics Division of General American Transportation Corporation includes: automotive air conditioning cabinet for O. A. Sutton Corp., Inc.; Silvertone portable TV cabinet for Sears, Roebuck and Co.; air duct and glove compartment for a leading automobile manufacturer; vending machine air duct for Vendo Co.

Premix moldings give you all three... quality, economy, versatility

Like to market better products and cut costs at the same time? Then premix moldings are for you!

When resins and reinforcing fibers are blended beforehand, more complex molds are not only possible but completely practical. Slots, grooves, holes, bosses and parts with varying wall thicknesses can be formed right in the mold. And whether the part is simple or complex, you'll get moldings with uniform strength and wall thicknesses. Premix moldings are improving products and cutting costs for a wide variety of industries using strong, rigid, reinforced plastics.

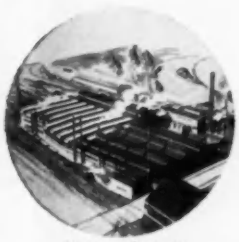
Molders across the nation rely on Dow Vinyltoluene and Dow Styrene for top-quality premix moldings. They can help you to better products at lower costs. For the names of molders and suppliers, contact your nearest Dow Sales office or write to THE DOW CHEMICAL COMPANY, Midland, Michigan, Plastics Sales Dept. 2206H-2.

YOU CAN DEPEND ON DOW

is your problem

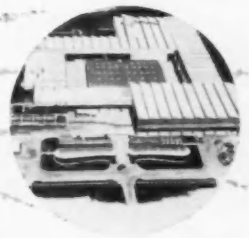
multiple sources?

NATIONAL *is the answer*



Melrose Park, Ill.

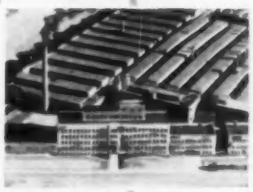
Indianapolis, Ind.



Phoenix, Ariz.

Sharon, Pa.

Chicago, Ill.



Cleveland, Ohio

Castings in—
malleable
HTM Metal
(pearlitic malleable)
carbon steel
alloy steel
manganese steel*
gray iron*

*Only from
Capitol Foundry Division
Phoenix, Arizona

Most companies insist on multiple sources to assure continuity of production. Often, the problem is to find *reliable* multiple sources.

By doing business with National *alone* you can continue this "multiple source" policy. For with National, individual jobs can be interchanged between plants . . . or equipment can be interchanged between plants.

This way you get all the advantages of dealing with *one* strong company . . . with unparalleled facilities of *many* plants. In addition, you issue *one* purchase order . . . get *one* invoice.

Result? With National you get single-source responsibility with multiple source flexibility. AA-7155

NATIONAL MALLEABLE and STEEL **CASTINGS COMPANY**

Established 1868 *Cleveland 6, Ohio*

The nation's largest independent producer of malleable and pearlitic malleable

Circle 214 on Inquiry Card for more data

That's one reason why over 50 per cent of all car buyers in a recent nationwide survey said they look for the car with the stainless trim! They know stainless doesn't rust, dent, scratch. They know it comes shining and clean with mere washing. And they know their car will bring more in *resale*, because stainless beauty is *lasting* beauty! The *best* stainless steels are made with Vancoram Ferro Alloys. Your supplier can give you more facts about the added value you can build into your autos — with *stainless steel!* Vanadium Corporation of America, 420 Lexington Avenue, New York 17, New York.

Producers of alloys, metals and chemicals

VANCORAM

VANADIUM CORPORATION OF AMERICA

Index to Advertisers

The Advertisers' Index is published as a convenience, and not as part of the advertising contract. Every care will be taken to index correctly. No allowance will be made for errors or failure to insert.

FREE LITERATURE

Angle Vises, Plates 1

Illustrated brochure AV-158 covers the Model 1A precision universal angle vise as well as a line of angle plates. Ideas useful in planning lower cost, compound angle precision setups for milling, drilling, planning, shaping, and grinding are given. *Wesson Co.*

Grinding, Lapping Units 2

A revised catalog includes details on the recently announced type S-3 6 by 18 in. hydraulic surface grinder, the No. 2 unitized transfer type crankpin grinder and the type CC-8 crank-o-matic semiautomatic crankpin grinder. *Norton Co.*

Teflon Tapes 3

Bulletin GST-58A, eight pages, describes a full line of standard and special CDF grades of glass supported teflon tapes, laminates, diaphragm stock and gasket stock. Tables of sizes and tolerances are included. *Continental-Diamond Fibre Corp.*

Turret Lathes 4

Form LO-5808, six pages, illustrates a ram type turret lathe equipped with Lynn hydraulic drive. This combination, in effect, makes an automatic out of a turret lathe. *Jones & Lamson Machine Co.*

Magnetic Components 5

Form 4MC describes production of pulse transformers, chokes, coil-core assemblies, and pulse-current transformers. *Levinthal Electronic Products, Inc.*

Ground Handling 6

A 24-page brochure, entitled "Blueprint for Manufacturing in the Space Age," illustrates major airframe, missile and ground support equipment. *Twin Coach Co.*

Assembly Machine 7

Bulletin AP-B2, four pages, features the auto-positioner for the placing and assembly of small piece parts. *Dixon Automatic Tool, Inc.*

(Please turn page)

Free INFORMATION SERVICE ON

new materials and components

new production equipment

advertiser's products and services

copies of technical literature

Use these postcards for Free Literature listed on these pages, or for more information on New Production Equipment and New Products advertised and described editorially in this issue.

USE FREE READER SERVICE CARDS

FIRST CLASS
Permit No. 36
New York, N. Y.

BUSINESS REPLY CARD
No Postage Stamp Necessary if Mailed in the United States

POSTAGE WILL BE PAID BY

AUTOMOTIVE INDUSTRIES
P. O. Box 66,
Village Station,
Readers Service Dept. New York 14, N. Y.

Postcard valid 8 weeks only. After that use own letterhead fully describing item wanted. **11/15/58**

Please send further information on items circled below.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140
141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160
161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180
181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220
221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240
241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260
261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	780
281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300

YOUR NAME ..... TITLE.....

COMPANY .....

PLANT ADDRESS .....

CITY ..... ZONE..... STATE.....

Free INFORMATION SERVICE

FREE LITERATURE — *Continued*

Carburetion 8

A booklet entitled "This business of LP-Gas Carburetion," describes how LP-Gas carburetion is used on lift trucks, and other equipment. *Ensign Carburetor Co.*

Storage Racks 9

Bulletin R-400, 11 pages, describes a wide variety of storage racks and includes drawings, photographs and diagrams. *Chicago Tramrail Corp.*

Heating Coils 10

Bulletin 890, 29 pages, describes the complete line of Herman Nelson heating coils. The coils in the bulletin are standard steam coils, steam distributing coils, and hot water coils. *American Air Filter Co., Inc.*

Rubber Molding 11

A four page bulletin describes a continuous automated process for high-volume production of precision custom-molded parts of any of the thermosetting elastomers. *Ohio Rubber Co.*

Controller Assembly 12

Complete information about Leeds & Northrup's Model S Speedomax G multiple-point recorder assembly for two-position control on many processes involving multi-zone control is available in two page Data Sheet ND46-33 (6).

Surface Grinder 13

Bulletin 2-161-1, eight pages, describes the model 161 rotary surface grinding machine which is used for precision grinding of flat, concave and convex surfaces of small work. *The Heald Machine Co.*

Steel Bars 14

A four page bulletin describes free machining Stressproof steel bars. The bulletin reviews new-user benefits resulting from improvements in strength, machinability, and tolerances. *La Salle Steel Co.*

Flowrator Meter 15

Specification bulletin 10A1700 O/U, six pages, features a glass tube variable-area flowmeter that gives indication of flow rate and provides a means of synchronizing secondaries. *Fischer & Porter Co.*

Industrial Trackwork 16

An eight page brochure describes trackwork which is used in mines, mills, and other industries which maintain in-plant rail trackage. *The Railroad Products Div., American Brake Shoe Co.*

L-Head Engines 17

Five completely revised two page bulletins describing Hercules six-cylinder L-head gasoline engines (Bulletins E-116, E-118, E-137, E-139 and E-163) have been issued by *Hercules Motors Corp.*

Servo Amplifiers 18

A four page brochure features Transi-Mag servo amplifiers with power ratings to 16W. *Magnetic Amplifiers, Inc.*

Postcard valid 8 weeks only. After that use own letterhead fully describing item wanted. **11/15/58**

Please send further information on items circled below.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140
141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160
161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180
181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220
221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240
241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260
261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	780
281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300

YOUR NAME ..... TITLE.....

COMPANY .....

PLANT ADDRESS .....

CITY ..... ZONE..... STATE.....

FIRST CLASS
Permit No. 36
New York, N. Y.

BUSINESS REPLY CARD
No Postage Stamp Necessary If Mailed in the United States

POSTAGE WILL BE PAID BY

AUTOMOTIVE INDUSTRIES
P. O. Box 66,
Village Station,
Readers Service Dept. **New York 14, N. Y.**

CITY ..... ZONE..... STATE.....

ORDER YOUR NEW SUBSCRIPTION Now!

FREE LITERATURE—
continued

Holding Devices 19

A twenty-eight page catalog describes a full line of holding devices to speed production, including a fixture lock for simplified jig construction. *Heinrich Tools, Inc.*

Speed Drives 20

Bulletin GEA-6234B, eight pages, describes general-purpose Thymotrol, adjustable speed drives, electrical and performance characteristics, and operator's control station of the drives. *General Electric Co.*

Power Supplies 21

A two-page catalog sheet illustrates a standard line of zero to 32 volt dc power supplies, with current ratings ranging from 5 to 40 amperes. All units are designed to operate from 115 volts ac, 60 cycles, single phase. *The Opad Electric Co.*

Motors, Generators 22

Catalog EI-4, 28 pages, describes Elinco synchronous motor designs as well as supplying technical information on the theory and application of all types of synchronous motors. *Electric Indicator Co., Inc.*

Alloy Powder 23

A 14 page bulletin describes alloy powder HS 6460. The powder was developed for use in higher stressed parts produced with existing operating equipment by the *Republic Steel Corp., Metal Powder Div.*

Seam Welder 24

Bulletin 316-7 completely describes type MP 1 air operated, press type, single phase seam welder which is designed to cover a wide range of commercial welding applications. *Sciaky Bros., Inc.*

(Please turn page)

AUTOMOTIVE INDUSTRIES

SUBSCRIPTION ORDER FORM

Subscription Price: To manufacturers in and suppliers to the automotive industries in the U. S., U. S. possessions and Canada, $2.00 per year; $3.00 for 2 years. ALL OTHERS, $10.00 per year.

Please enter my subscription to Automotive Industries for:

☐ $3.00 for Two Years ☐ $2.00 for One Year ☐ $10.00 for One Year

NAME..... TITLE .....

COMPANY NAME .....

PLANT ADDRESS .....

CITY & STATE .....

PRODUCT MANUFACTURED .....

☐ Payment enclosed ☐ Bill me ☐ Bill Company

IMPORTANT—Please fill in completely. We cannot enter your subscription without this data.

AUTOMOTIVE INDUSTRIES

SUBSCRIPTION ORDER FORM

Subscription Price: To manufacturers in and suppliers to the automotive industries in the U. S., U. S. possessions and Canada, $2.00 per year; $3.00 for 2 years. ALL OTHERS, $10.00 per year.

Please enter my subscription to Automotive Industries for:

☐ $3.00 for Two Years ☐ $2.00 for One Year ☐ $10.00 for One Year

NAME..... TITLE .....

COMPANY NAME .....

PLANT ADDRESS .....

CITY & STATE .....

PRODUCT MANUFACTURED .....

☐ Payment enclosed ☐ Bill me ☐ Bill Company

IMPORTANT—Please fill in completely. We cannot enter your subscription without this data.

Postcard valid 8 weeks only. After that use own letterhead fully describing item wanted. **11/15/58**

Please send further information on items circled below.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140
141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160
161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180
181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220
221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240
241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260
261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	780
281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300

YOUR NAME ..... **TITLE**.....

COMPANY .....

PLANT ADDRESS .....

CITY ..... **ZONE**..... **STATE**.....

Free INFORMATION SERVICE

FREE LITERATURE—*Continued*

FIRST CLASS
Permit No. 18
Philadelphia 39, Pa.

BUSINESS REPLY CARD
No Postage Stamp Necessary if Mailed in the United States

POSTAGE WILL BE PAID BY

AUTOMOTIVE INDUSTRIES

Chestnut & 56th Sts.

Philadelphia 39, Pa.

FIRST CLASS
Permit No. 18
Philadelphia 39, Pa.

BUSINESS REPLY CARD
No Postage Stamp Necessary if Mailed in the United States

POSTAGE WILL BE PAID BY

AUTOMOTIVE INDUSTRIES

Chestnut & 56th Sts.

Philadelphia 39, Pa.

FIRST CLASS
Permit No. 36
New York, N. Y.

BUSINESS REPLY CARD
No Postage Stamp Necessary if Mailed in the United States

POSTAGE WILL BE PAID BY

AUTOMOTIVE INDUSTRIES

P. O. Box 66,

Village Station,

Readers Service Dept. **New York 14, N. Y.**

Diesel Engine Controls 25

Bulletin B45-1, 24 pages, describes temperature and pressure control systems for Diesel engines, safety devices, tachometers, control motors, valves, switches, and related accessories. *Minneapolis-Honeywell Regulator Co., Industrial Div.*

Packmaster Machines 26

Packmaster machines are capable of flat or dome-type enclosures for hardware, strip trim, spare parts and similar items as described in a three page bulletin by the *American Broach Div., Sundstrand Machine Tool Co.*

Hydraulic Components 27

Bulletin 1502 B1, two pages, describes a line of directional control valves, accumulators, cylinders, hose assemblies and tube fittings. *Parker Hydraulics Div., Parker-Hannifin Corp.*

Lift Truck Cylinder 28

Folder F-1202, six pages, describes operating data, and specifications for a line of lift truck cylinders. Features and advantages of these cylinders, as well as the extra benefits are explained in detail by the *Linde Co., Div. of Union Carbide Corp.*

Welding Equipment 29

A catalog illustrates a complete line of precision electronic welding equipment. This line includes cabinet welders, bench welders, and accessories designed to fit a variety of industrial requirements. *Vacuum Tube Products Co.*

Barrel Finishing Media 30

Form A-23-P1 describes such grinding, burnishing, and rust inhibiting ALMCO compounds. Medias include bonded, oxide, regular, limestone, granite, and ceramic chips. Other miscellaneous barrel finishing medias are also covered. *ALMCO Queen Products Div., King-Seeley Corp.*

The "Long Life" Piston with Cast-Anchored Steel Top Ring Section

CONTINUOUS PERMA-GROOVE*

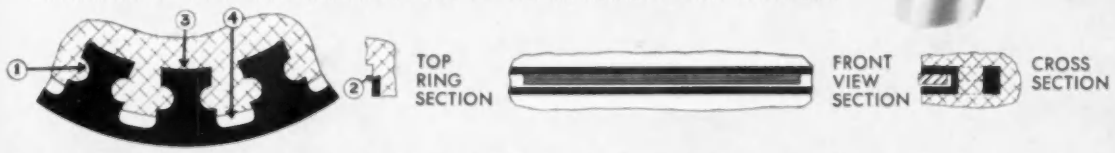
SUPERIOR PERFORMANCE FOR GASOLINE ENGINES

- ★ HIGHEST WEAR RESISTANCE
- ★ COOL OPERATION
- ★ MINIMUM OIL CONSUMPTION
- ★ MINIMUM WEIGHT INCREASE
- ★ ECONOMICAL IN COST
- ★ ADAPTABLE TO ANY TYPE PISTON

We suggest an immediate test of "Continuous Perma-Groove" advantages for your gasoline engine.

*T.M. Reg. Pat. App. For

ENGINEERING ADVANTAGES OF ZOLLNER "CONTINUOUS PERMA-GROOVE"



1. Cast-anchored—no bimetal expansion problem.
2. Dovetailed edges keep insert securely in place.
3. 100% steel bearing area for wear resistance.
4. 40% aluminum bearing area exposed for heat conductivity and cool operation.
5. Light in weight.

Advanced Engineering

Precision Production

Cooperation with Engine Builders

ZOLLNER PISTONS

THE ORIGINAL EQUIPMENT PISTONS

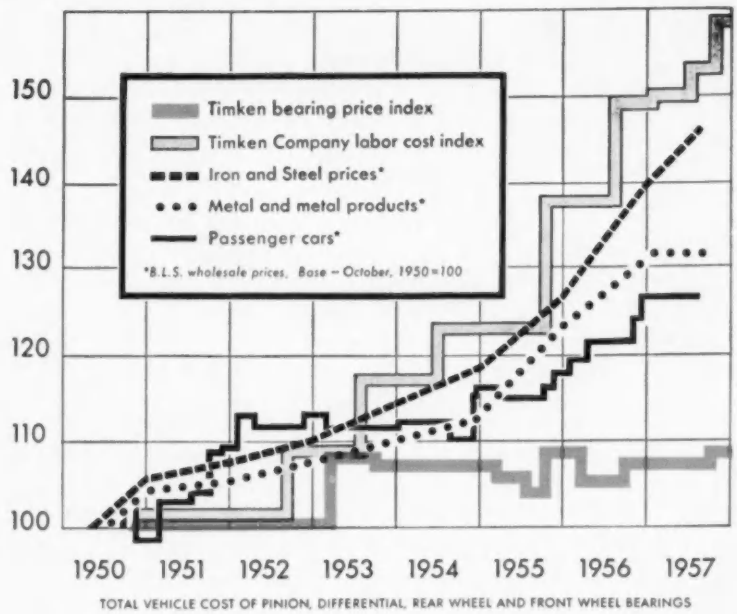
ZOLLNER

ZOLLNER CORPORATION • Fort Wayne, Indiana

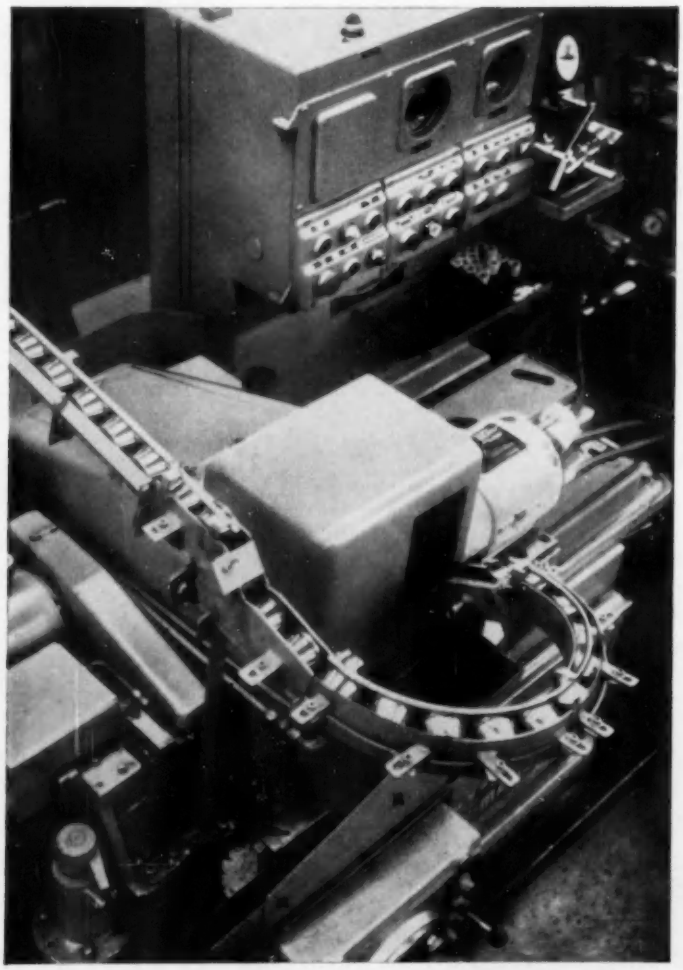
Circle 102 on Inquiry Card for more data

What's way up? Everything but Timken® bearings

Chart the cost of most anything over recent years and it looks like a flight of stairs (see right). But the cost of Timken® tapered roller bearings for the automotive industry has held the line. The auto industry has helped us beat inflation by standardizing on the new Timken bearing sizes produced by revolutionary new techniques that have all industry buzzing.



TOTAL VEHICLE COST OF PINION, DIFFERENTIAL, REAR WHEEL AND FRONT WHEEL BEARINGS



Here's how to keep 'em way down

Here's the inside of our unique Bucyrus, Ohio, plant where custom-made machines turn out 30 million new design Timken bearings a year without a hand touching them. This plant can keep your bearing costs down if you: 1) standardize on even fewer Timken bearing sizes—lowering our production costs, increasing your savings; and 2) buy more Timken bearings—the bearings made by low-cost missile age techniques. The more you put standardization to work, the better we can keep your bearing costs down. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

BEAT INFLATION WITH... STANDARDIZATION

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

Circle 103 on Inquiry Card for more data